A PROSPECTIVE STUDY OF

ANALYSIS OF SHORT TERM FUNCTIONAL OUTCOME OF VERTEBROPLASTY IN OSTEOPOROTIC VERTEBRAL WEDGE COMPRESSION FRACTURES

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CERTIFICATE

This is to certify that this dissertation entitled **' ANALYSIS OF SHORT TERM FUNCTIONAL OUTCOME OF VERTEBROPLASTY IN OSTEOPOROTIC VERTEBRAL WEDGE COMPRESSION FRACTURES '** is a record of bonafide research work done by **Dr. J. DAVID VIMAL KUMAR** , post graduate student under my guidance and supervision in fulfillment of regulations of The Tamilnadu Dr. M.G.R. Medical University for the award of M.S. Degree Branch II (Orthopaedic Surgery) during the academic period from May 2011 to April 2014, in the Department of Orthopaedics, Govt. Royapettah Hospital & Govt. Kilpauk Medical College, Kilpauk, Chennai-600010

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DECLARATION

I, **Dr. J.DAVID VIMAL KUMAR,** solemnly declare that the dissertation, **'ANALYSIS OF SHORT TERM FUNCTIONAL OUTCOME OF VERTEBROPLASTY IN OSTEOPOROTIC VERTEBRAL WEDGE COMPRESSION FRACTURES '** is a bonafide work done by me in the Department of Orthopaedics, Govt. Kilpauk Medical College, Chennai under the guidance of

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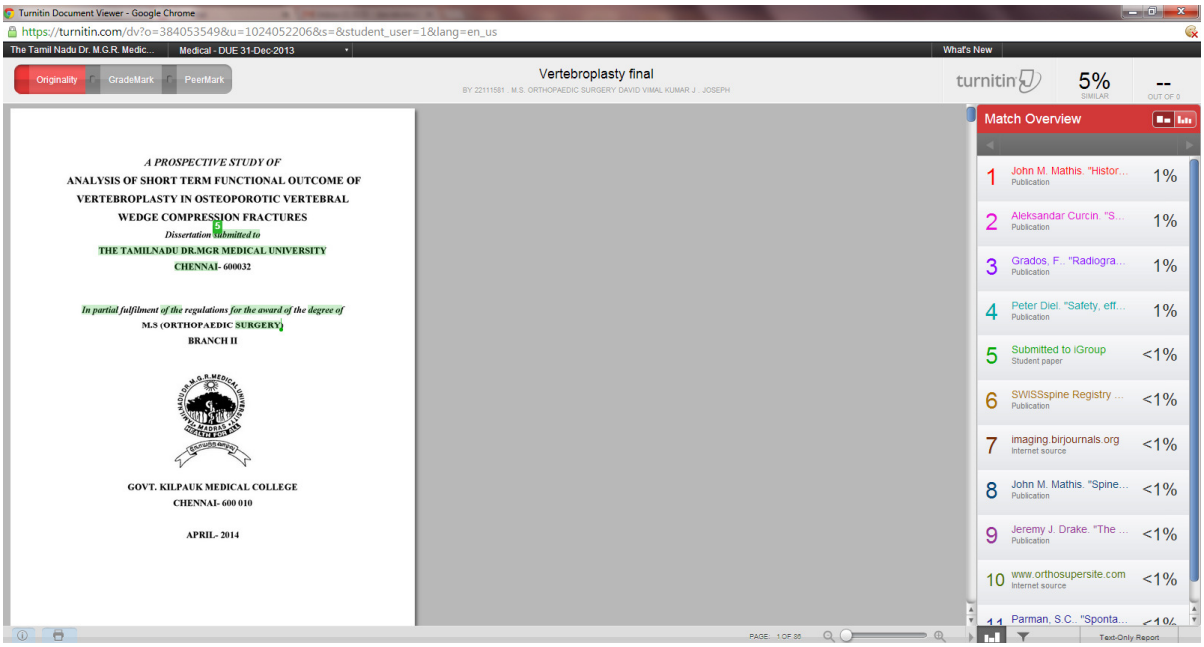

CONTENTS

A PROSPECTIVE STUDY OF

ANALYSIS OF SHORT TERM FUNCTIONAL OUTCOME OF VERTEBROPLASTY IN OSTEOPOROTIC VERTEBRAL WEDGE COMPRESSION FRACTURES

AIM

To evaluate and analysis the short term functional outcome of Vertebroplasty in the management of Osteoporotic wedge compression fracture.

MATERIALS & METHODS

A total of 35 patients were taken up in the study. The age of the patient was in the range of 52 -80 years. There were 13 males and 23 females in this study. On presentation in outpatient department true Anterior – posterior and true Lateral views X-rays of injured spine were taken &vertebral wedge compression fractures diagnosed. Baseline demographic and injury characteristics were noted. Patient's vertebral wedge compression fractures were classified according to the Denis Classification managed conservatively for 4 weeks with analgesics and brace. The patients those who were presented with persistent intolerable low back pain, with or without radiating pain, all without any neurological deficit,inability to do daily activity of living and these patients were admitted through outpatient department. Neurological chart which included assessment of motor status, sensory status bowel & bladder status were noted. This was done for the purpose of comparison of post operative neurological status .In all patients, Pre operative Visual analog score for back ache, Oswestry

disability score & Oswestry disability index were noted for the purpose of comparison of post operative functional outcome

OBSERVATION & RESULTS

In our study,35 Patients with osteoporotic vertebral wedge compression fracture were considered for the analysis.Average follow up was done for 8 months with maximum follow up was for 18 months and minimum follow up was for 3 months. There were 27 cases with more than 6 months of follow up and 11 cases with more than 12 months follow up.Statistics comparing preop VAS score versus VAS score, , pre op ODS vs post op ODS at immediate, one month, three months, six months were done from which we interpreted that p value < 0.0001 in all postoperative period, so it was a significant comparison. Statistically, we got significant pain relief and functional outcome in immediate post operative period which was maintained at the end of 6 months also.

CONCLUSION

we conclude that the Vertebroplasty are promising innovations with the benefit of quick improvement in mobility, markedly decreases pain-related doctor visits, stature, and decreases use of NSAIDS post operatively in the management of osteoporotic wedge compression fracture.

KEYWORDS – Vertebroplasty ,Osteoporosis, Compression, Pain,Denis.

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INTRODUCTION

Vertebral compression fracture is the most common problem in old age causing incapacitating pain which produces significant morbidity, disability and mortality.

Osteoporosis being the most common disorder of bone in this old age group, affecting approximately 120 million people worldwide. Over 61 Million Indians have osteoporosis, out of which 80% are women. On a global basis, Indians have the highest prevalence of osteopenia [(1).] Compared to Western population, fractures related to osteoporosis in the Indians occur a decade earlier in age. On average 45 Lakh Indian females above 60yrs of age have a fractured spine compared to osteoporotic hip fractures every year which is 2.5 lakhs[(2)].

So vertebral compression fractures are the most common osteoporotic fracture, one vertebral compression fractures occurs every 45 seconds. 30-50% of all women develop vertebral compression fractures during their life time [(3).]At the age of 75 yrs- 25% of all women have at least one vertebral compression fractures which increases to 50% at the age of 80yrs.

One vertebral compression fracture – 4 times chance of 2nd vertebral compression fracture, if Second fracture – 12 times higher chance of further compression fractures. It has been estimated that annual cost – 25 Billion Euros / year are being spent in the management of vertebral compression fractures [(4).] A conventional treatment of

compression fractures includes bed rest, life style modifications, analgesics, bracing and supplementary osteoporotic interventions.

Ultimately vertebral compression fractures can lead to profound pain, morbidity, disability, and reduced life expectancy which has great impact on healthcare systems [5]. Approximately 33% of the patients do not respond to conventional pain medication and conservative treatment. This leads to reduced inactivity and mobility which in turn leads to further bone loss and other problems like atelectasis, pneumonias, deep vein thrombosis, pulmonary embolism and so on [5]. In senior citizens, these morbidities cause loss of independence and reduced daily activities leading to social isolation and depression [6]. The fractured osteoporotic vertebrae may also progress to collapse and may lead to progressive burst fractures leading to kyphosis with variable degrees of cord compressions and further complications. So the need to stabilize the fractures besides the medical treatment and braces is mandatory. Vertebroplasty a type of vertebral augmentation techniques is one of the important recent advances minimally invasive approaches in wedge compression fractures which offer symptomatic immediate long lasting pain relief significantly [7].

AIM OF THE STUDY

To evaluate and analysis the short term functional outcome of Vertebroplasty in the management of Osteoporotic wedge compression fracture.

REVIEW OF LITERATURE

HISTORY AND DEVELOPMENT OF VERTEBROPLASTY

For many decades, Vertebroplasty is used as an open augmentation procedure of pedicle screws for spinal instrumentation. In the augmentation procedure bone grafts or cement is placed into the bodies of vertebrae to augment mechanically and thereby increasing structural strength [8, 9]. It was one such procedure which made the beginning for the development of Percutaneous Vertebroplasty.

In History, Galibert and Deramond were performed the Vertebroplasty in the Radiology Department of Amiens University Hospital, France, in 1984 on a female, aged 54, with severe cervical radiculopathy pain for several years [10, 11, 12, and 13].

The same patient cervical spine x-ray showed normal in 1979, but in 1984, she admitted with intolerable cervical pain associated with a severe radiculopathy localized to the C2 nerve root & her radiograph showed a vertebral hemangioma of C2 vertebra. Computed tomography (CT) showed vertebral hemangioma of C2 vertebra with epidural involvement. In first stage C2 laminectomy was done, and the involved epidural component of vertebral hemangioma was excised. To obtain structural and mechanical augmentation of the C2, it was decided that augumentation procedure Vertebroplasty would be done.Vertebroplasty was done through an anterolateral approach, 15-gauge

Needle was placed into the vertebral body of C2 and volume of 3ml PMMA (Poly Methyl Methacrylate) cement was injected following which patient had complete pain relief. Subsequently in six other patients Vertebroplasty was tried and the results were published in 1987[10].

Much knowledge & experience of vertebroplasty was gained by experimental works conducted on cadaveric prosection studies, later which helped in arriving and establishing technical aspects of the procedure [10, 11].

Figure 1- Vertebroplasty (First Case) (A) X-ray Cervical spine -Lateral view showing a needle in the Vertebral Haemangioma (B) Lateral view showing post Vertebroplasty

On the studies of cadavers and patients, the following suggestion was given by Deramond [10, 11]:

- Large bore 10 G needle for thoracic & lumbar vertebrae and 15 G needle for cervical vertebrae
- Addition of Tantalum to the PMMA to radio opacity and to facilitate easy visualization of the cement during the procedure
- Initially in one patient Posterolateral approach caused intercostals neuralgia because of cement leakages along the trajectory of the needle, hence safe transpedicular approach was developed.

Other doctors from the neurosurgical teams & radiology department of the University Hospital in Lyons (France) inspired by the good result of the first vertebroplasty, used 18-gauge needles to inject cement PMMA into the pathological vertebral bodies of seven patients: four osteoporotic patients with vertebral compression fracture (VCFs), two cases with haemangioma of vertebral body, and one patient with spinal metastasis ,out of them six reported excellent and one reported good results of pain relief [10,11,12,113,14].

Later on the other doctors from the university hospital, Lyon, France used this surgery for weakened osteoporotic vertebrae of seven patients and in one with metastatic lesion and out of them six reported excellent results and one reported good results for pain relief. This procedure eventually was popularized in USA for vertebral compression fractures.

In the early 1990s, Vertebroplasty (Deramond's technique) was established and popularized first at the University of Virginia in the United States [10]. Since then,

(Deramond's technique) Vertebroplasty has become a more widely popularized method in the management of pain in vertebral body diseases.

The European has focused on the management of pain related to neoplastic conditions both benign tumors and malignant tumours [14, 15], whereas the Americans focused on management of pain in Osteoporotic compression fractures.

Until the introductions of Vertebroplasty, there were only few management options were available for pain management in the Compression fractures. The immediate and long lasting pain relief with vertebroplasty is quickly making it has an accepted treatment option in the management of osteoporotic vertebral compression fractures .Finally , It has made new footmark in the field of spine surgery in the management of compression fractures of osteoporotic vertebrae.

SPINE ANATOMY

The Vertebroplasty require most perfect localization of pedicle, careful monitoring of the trajectory path of the spine to be treated, must be observed & followed for Vertebroplasty. For that anatomical and pathological structures of vertebrae must be well understood to achieve this goal.

Totally 33 vertebrae consists of entire spine: Of which cervical 7 vertebrae, thoracic vertebrae 12, and 5 lumbar vertebrae 5. The vertebrae of sacrum and coccyx provide unique variations [16]. Of which sacrum is composed of 5 vertebrae that are fused & coccyx have 4 vertebrae that are fused.

The entire spinal vertebrae are interconnected by 23 intervertebral discs and structurally by ligaments and paraspinal muscles.

The whole spine is illustrated in Figure 2, which shows the anatomical curvature that varies from cervical vertebrae to sacral vertebrae. In the lateral view, the cervical & lumbar segment shows lordosis, and thoracic and sacral regions shows mild kyphosis. These curvature variations are significant since they alter the pedicle anatomical orientation of the individual vertebral segments which are commonly used for direct access to the vertebral body as in posterior stabilization (pedicle screw fixation), Percutaneous Vertebroplasty and balloon kyphoplasty [16].

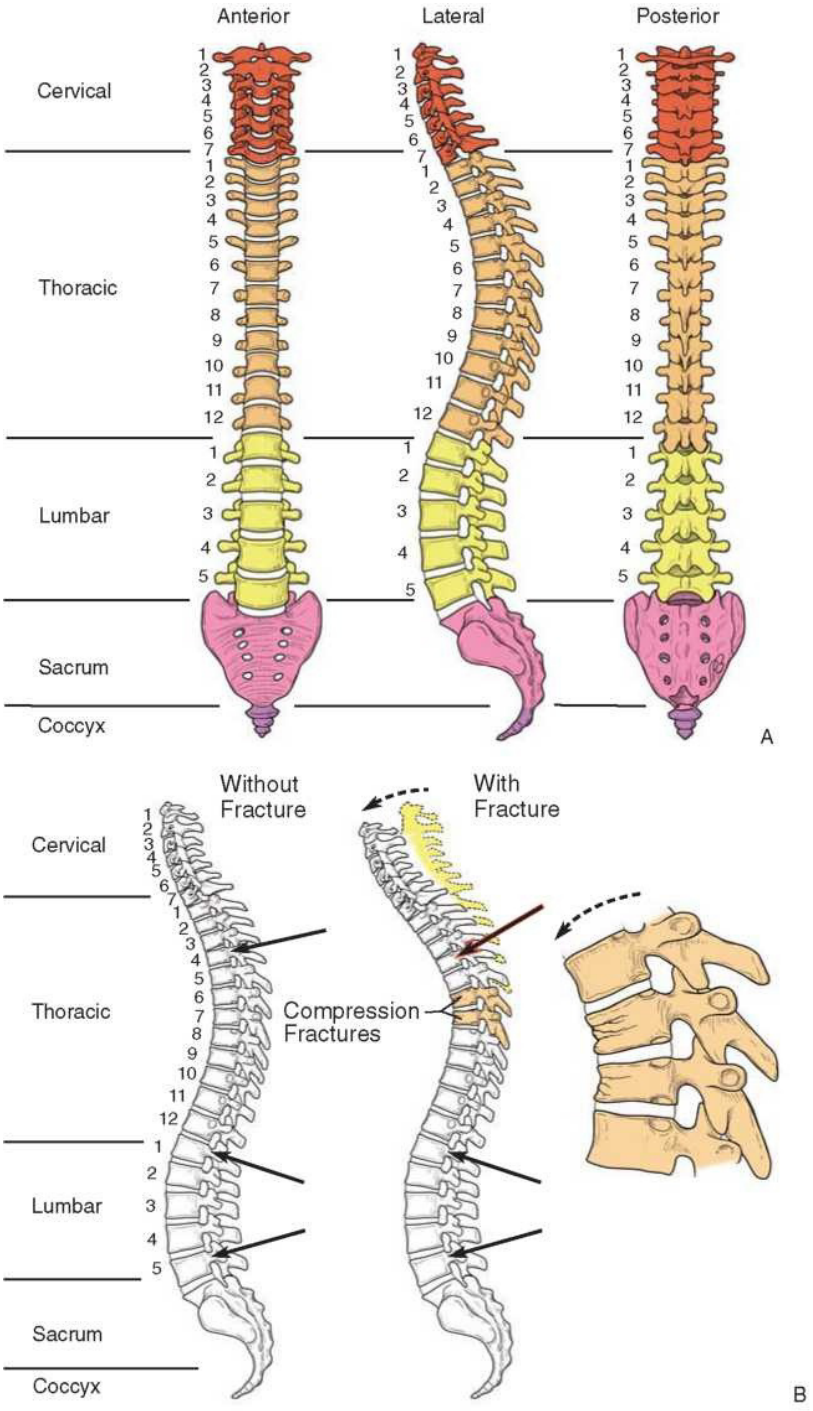


Figure 2- Anterior, posterior& Lateral aspects of the entire spine

Table 1 Vertebral volume in various vertebral bodies [17]

Vertebra	Anatomical volume (ml)	Fillable volume (ml)	Compressed volume (ml) 50%
C5	7.2	3.6	1.8
T9	15.3	7.65	3.8
L3	22.4	11.2	5.6

CERVICAL SPINE:

In the cervical spine, Osteoporotic vertebral compression fractures are rare. The cervical spine most commonly approach via the antero-lateral approach [18]. Usually right side is selected to avoid the needle damaging the esophagus (which is situated behind or left to the trachea). In higher level vertebrae sometimes it can also performed through trans-oral approach [19]. There are chances of injuring the vertebral artery if lateral approach is used, so it's not optimum for vertebroplasty.

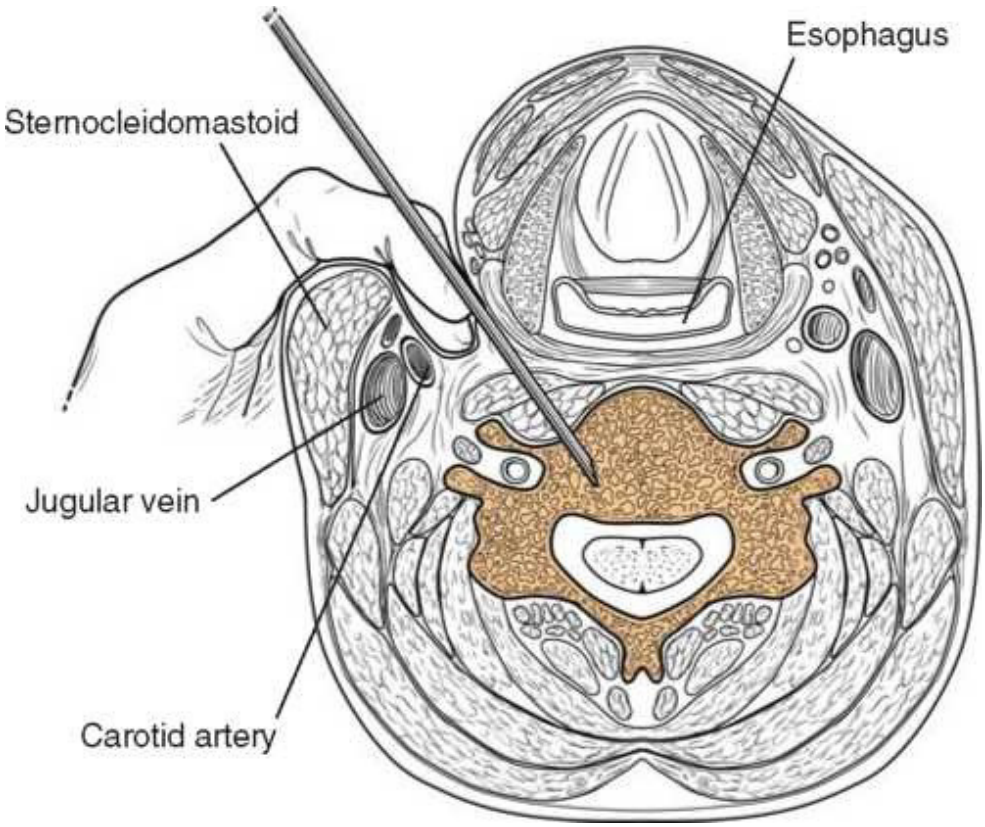


Figure 3- Anterior approach to cervical vertebrae. Cross section shows isolation of the carotid artery & jugular vein during needle insertion. Note to avoid the damage to esophagus, right side is selected.

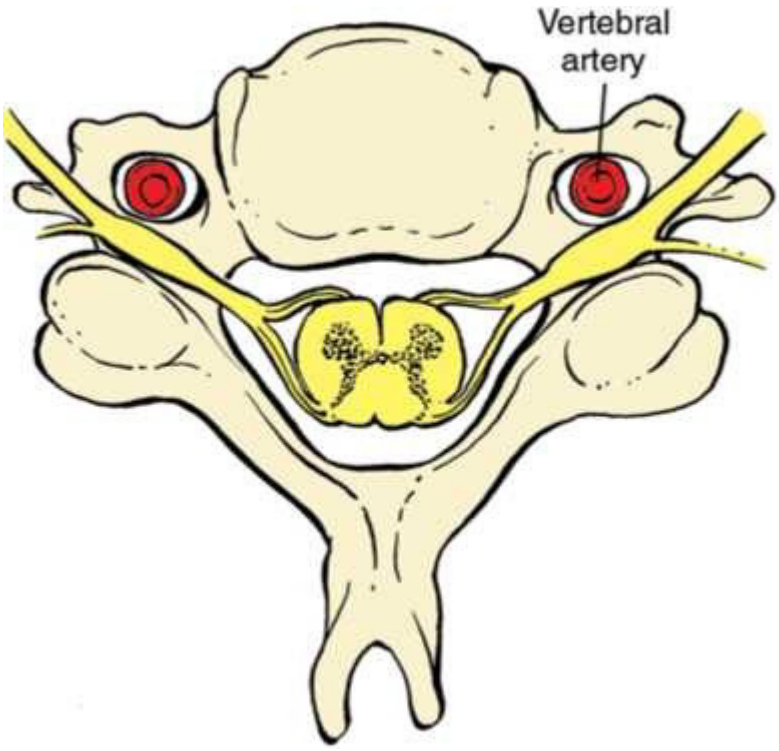


Figure 4- Axial view of cervical spine shows the vertebral artery course.

THORACIC SPINE

The thoracic spine is composed up of 12 vertebrae with a mild kyphosis in the healthy spine.

The thoracic spine pedicles are bounded laterally by the cost vertebral ligaments, ribs. The adjacent neural foramen bounds the pedicle superiorly and inferiorly.T4 Vertebra has the smallest pedicle which has the dimension of 4.5 mm in diameter and T11 vertebra has largest pedicle dimension which has the dimension of 8mm in diameter [(20)]. The Average pedicle sizes varies around 6 to 8 mm in T1 to T12 .The pedicle sizes dimension may be of 10 mm in height and 4 mm in width between T3 & T6 pedicle. In the low thoracic T 12 vertebra, pedicle is 14 mm in height and 8 mm in width at T12

level. Pedicle orientation shows convergence angle at the transverse plane. There are regional differences of convergence in transverse angles, of these largest at T1 –which is 30 degrees & there is a gradual decrease in angulations as one move caudally down, with a minimum inclination of the T12 which is of 0 degrees approximately. These pedicles show downward inclination at the sagittal plane and it runs posterior superior to anterior inferior direction, around 20 degrees [20, 21, and 22].

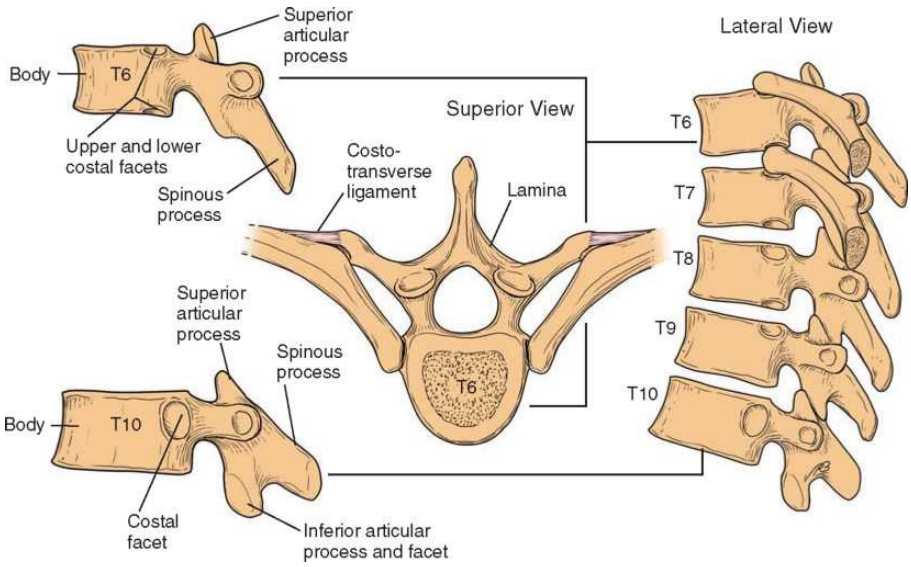


Figure 5- Thoracic spine Anatomy

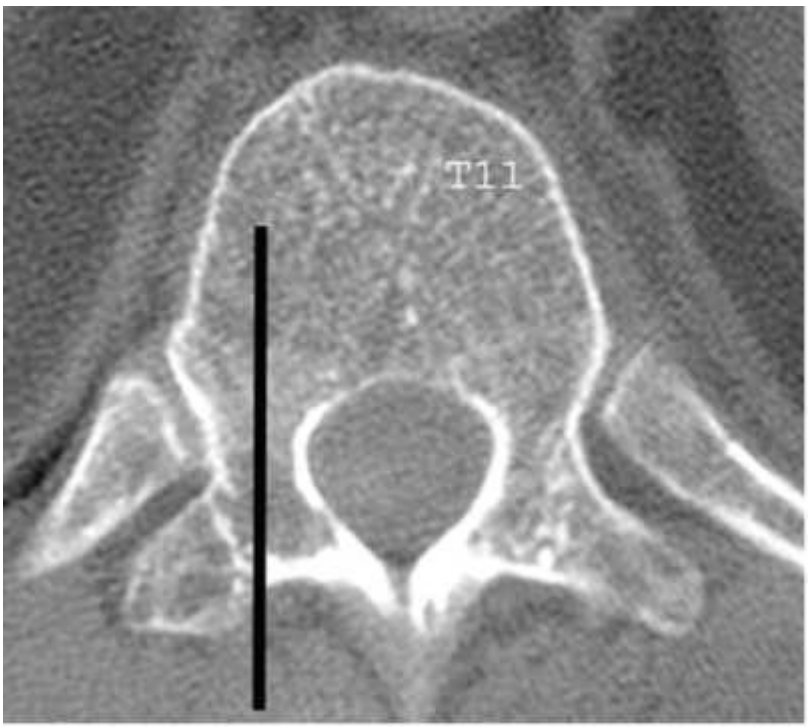
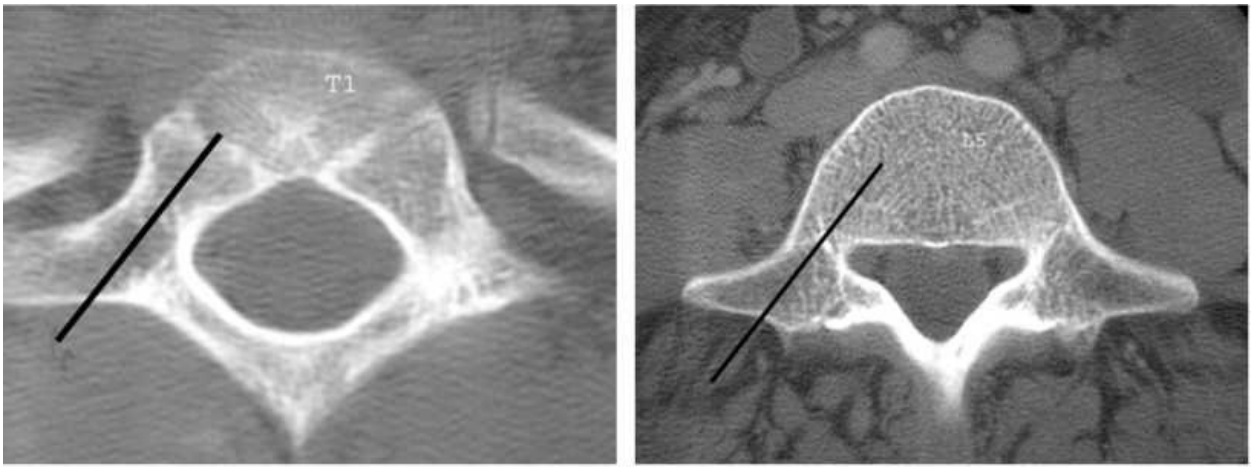


Figure 6 (A) T11 pedicle showing the zero or neutral angle which is straight in the anterior to posterior axes.

(B) T1 pedicle showing the large difference in the angle compared with T11 transpedicular angles in anteroposterior axes.

(C) Both highest T1 thoracic pedicle and lowest L5 lumbar pedicle shows the most Extreme transpedicular angles.



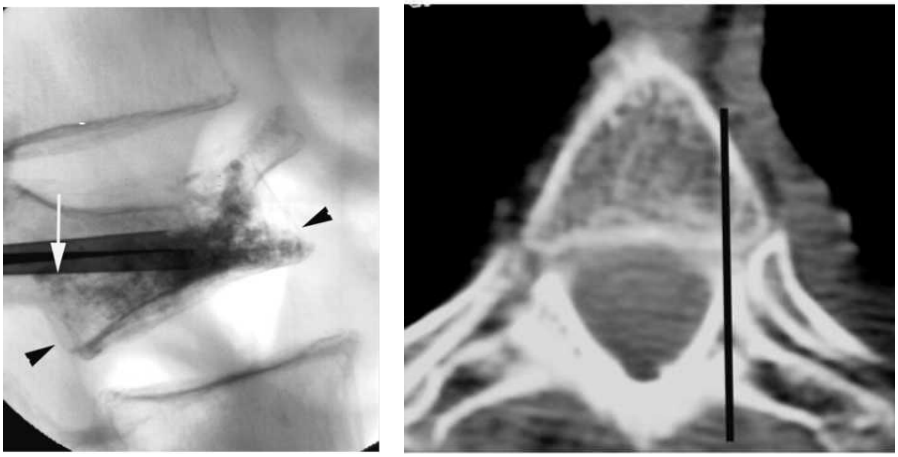


Figure 7- (A) A C -arm lateral view showing the anterior and posterior vertebral margin extents (black arrows).B, Axial view shows concave posterior margin & convex anterior margin.

As shown in the lateral projection (Figure 7) while placing a needle through a straight AP pedicle orientation, there is a chance of breaching the anterolateral wall before reaching the actual anterior limit.

In general, the sagittal diameter is slightly larger and the transverse diameter changes from 4.5 mm at T4 to 18mm at L5, The angle of pedicle that emerges from the body in the transverse plane also varies with craniocaudal location, being less than 10 degrees at thoracic spine and increases up to 30 degrees at lumbar spine. The pedicles are directed approximately 15-17 degrees cephalad for the thoracic spine, neutral for most of lumbar spine and 18 degrees caudal at L5.The distance from anterior vertebral cortex to the posterior aspect of the pedicle would be 40-45mm at thoracic spine and 50mm in the lumbar spine. The fixation strength of thoracic and lumbar pedicle screws is approximately 60% which is in the pedicle itself, with further 15-20% provided by the

vertebral body and another 20-25% provided by the purchase in the anterior cortex. However the values are reversed in sacrum, where anterior cortical fixation increases the pull out strength by 60%.

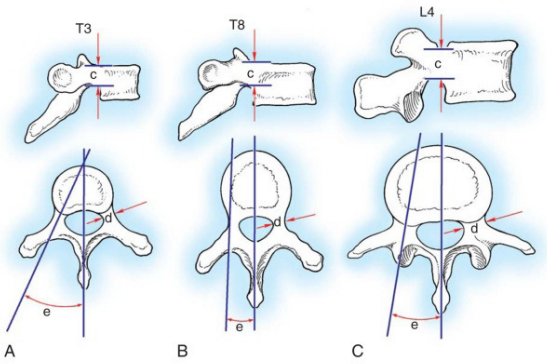


Fig. 34-4 A-C, Pedicle dimensions of T3 **(A),** T8 **(B),** and L4 **(C)** vertebrae. Vertical diameter (c) increases from 0.7 to 1.5 cm, horizontal diameter *(d)* increases from 0.7 to 1.6 cm with minimum of 0.5 cm in T5. Direction is almost sagittal from T4 to L4. Angle *(e)* seldom extends beyond 10 degrees. More proximally, direction is more oblique: T1 = 36 degrees, T2 = 34 degrees, T3 = 23 degrees. L5 is oblique (30 degrees), but is large and easy to drill.
(Redrawn from Roy-Camille R, Saillant G, Mazel CH: Plating of thoracic, thoracolumbar, and lumbar injuries with pedicle screw plates, Orthop Clin North Am 17:147, 1986.)

Figure 8- Pedicel dimensions

APPROACH

The transpedicular approach is the safest & most commonly used, but it is difficult to use 10-11 gauge large-bore needles in smaller pedicle. It can be avoided by decreasing the bore size of needle to 13 gauges.

In parapedicular approach[21,22,23,24], (Figure 9) needle is placed lateral to the pedicle above the transverse process which could allow placement of a larger instruments (used in Kyphoplasty) or not adequately visualized pedicle because of destroyed pedicle or poor quality of imaging or osteoporosis [23,24,25,26]. But it is not advised as the primary

method of access because of its higher complication rate related to either hemorrhage or pneumothorax. The anterolateral approach can be used in upper thoracic spine (T1-T2), as in cervical spine.

LUMBAR SPINE

The lumbar spine consists of five lumbar vertebrae (Figure 10) with size variations from L1 to L5 vertebra. Orientation of pedicle is quite different from L1 to L5pedicle. The lumbar pedicles of upper lumbar vertebrae are identical to the lower thoracic pedicle with a nearly straight AP pedicle orientation. At lower pedicles of lumbar vertebra it becomes a more oblique angle and it becomes maximal at L5 pedicle.

The approach is always transpedicular almost both in Vertebroplasty or Kyphoplasty (Figure 9). The large lumbar spine pedicles allow access with 10-11 gauge needles without difficulty. Although the parapedicular method (Figure 9) remains a viable option but it is used very less because of the large lumbar pedicle size.

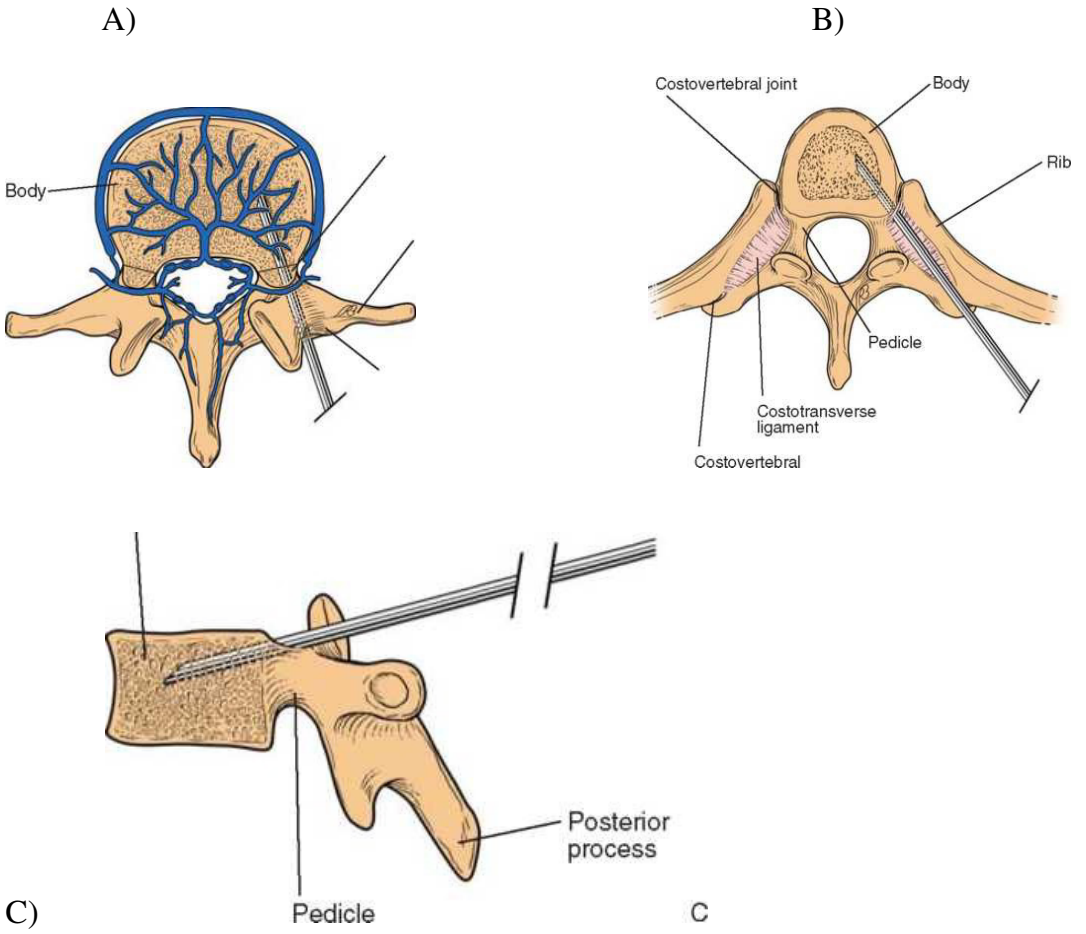


Figure 9-(A) Transpedicular approach. Large bore needle is placed in the anterior one third of the body. (B) Parapedicular (transcostovertebral) approach. (C) Lateral view showing the parapedicular approach.

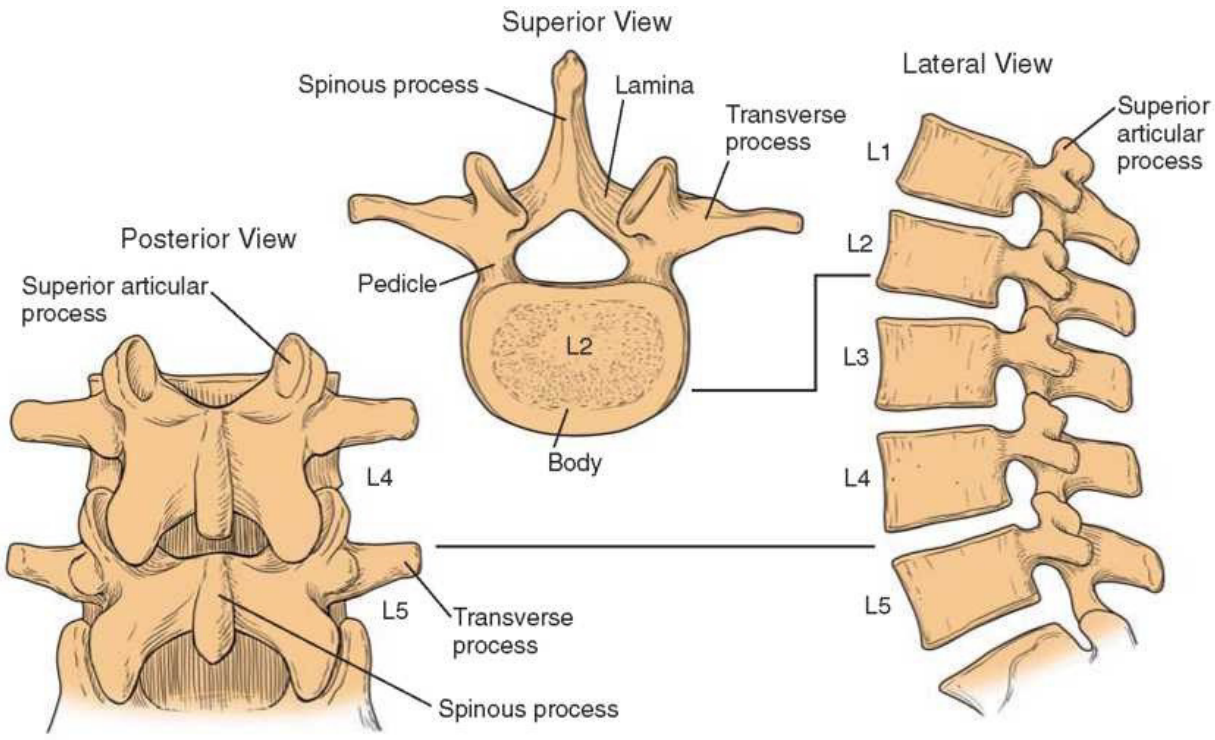


Figure 10 - The lumbar vertebrae

VASCULAR ANATOMY

From the branches that directly come from the aorta, supplies the vertebral bodies .These branches supplying the body of vertebra which runs along the lateral borders of the vertebrae, exiting nerve roots and the epidural space (Figure 11)([17,24,25,26].

In the paraspinous region of vertebrae superior and inferior aspect shows the communications between these branches. Through the three interconnecting, valveless venous systems drains the Vertebra namely [17, 24]

- epidural venous system
- interosseous venous system, and

- paravertebral venous system

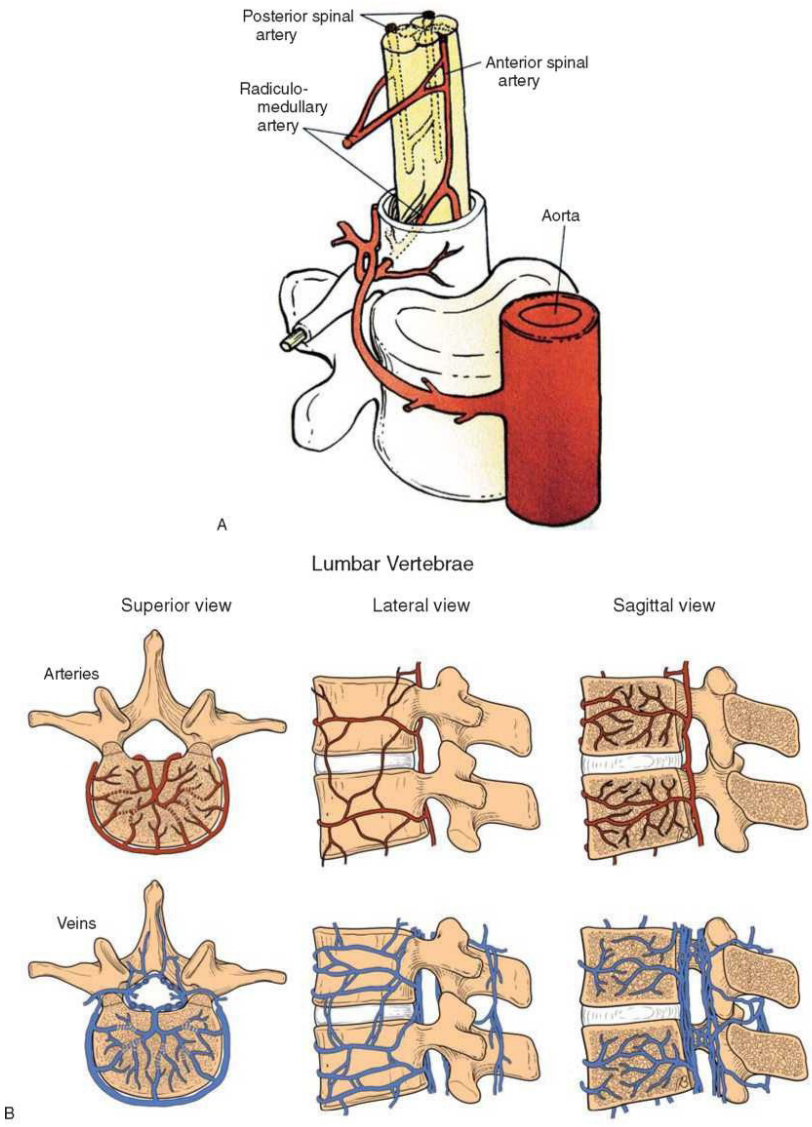


Figure 11- (A) Aortic branches supplies the body of vertebra and lastly to the spinal cord. These branches are situated bilaterally.

(B) Multiple channels of the arterial anastamosis and venous confluences supplying the bodies of vertebrae and epidural space. Venous confluences are more numerous at all levels compared with the arterial branches.

All these systems have intimate communication with the inter-trabecular space and intra osseous as well (Figure 11). At the pressure of venous system marrow fat & blood products are present in this space are intercommunicated with flowing blood. During either Vertebroplasty or Kyphoplasty the cement is injected into this space only. Intertrabecular space communicates through the connecting venous systems can cause the potential cement leak in the lateral, anterior or posterior. The basivertebral venous system forms the posterior communication, which is the largest draining venous channel from the vertebrae. All these venous confluences of vertebral body directly communicate to the epidural venous system of the spinal cord & the exiting nerve roots. The Lateral venous system from the vertebral body communicates with the paravertebralveins [(17)].These Para vertebral veins situated in the lateral border of the vertebral body runs in both vertical & horizontal directions, and also interconnects anterior central venous elements & the posterior epidural venous system. The large central venous channels composed of the azygos forms the anterior central venous system which ultimately drains into the inferior vena caval veins that lastly drains venous blood to the lungs.

We can avoid or minimize the direct entry of cement into the exiting vascular channels by placing the tip of needle away from the major vessel lumen and doing intraosseous venogram, [(17, 20, and 24)]. This risk is highest in the posterior vascular system of the vertebra. Anterior and Lateral communications are generally much smaller than to the posterior basi-vertebral plexus. The cement distribution is controlled by injecting slowly or using rat tail consistency of high viscosity cement with minimal resistance flow. If

encountered accidentally, inject cement slowly with minimal pressure away from the low pressure large channels. With careful continuous observation for the type of cement distribution and filling will avoid the further leaks and prevents the serious complications like cardiac arrest due to cement embolism into the large venous systems.

FRACTURE BIOMECHANICS

Muscles on back act like a tension band counteract flexor loading forces [27, 28, and 29]. Tension band depends on functional state of muscles and intact ligaments. Load distribution Ventral column -80% compressive loads & dorsal column -20% as shearing force.

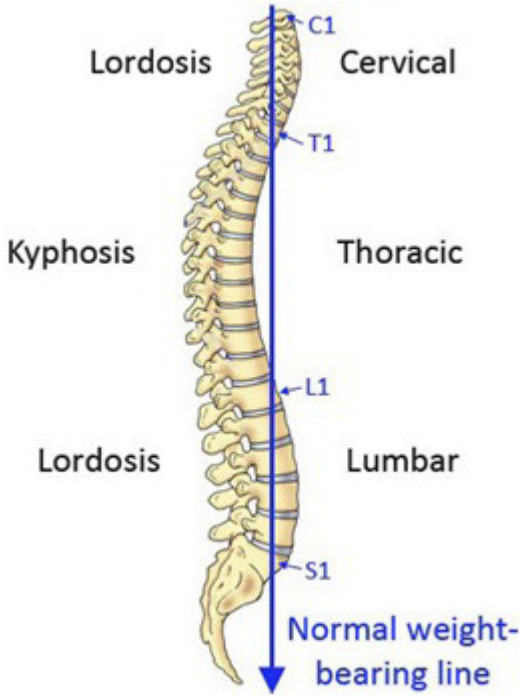


Figure 12- Normal weight Bearing

Osteoporotic fractures

The patients with osteoporosis (with poor bone density) minor trivial injuries like self fall, travelling in motorcycles, sitting down hard on a bench or even daily activities of living like lift heavy objects from the floor or bending over to make a bed can cause a mild wedge compression fractures[27,28,29,30].

SPINAL INSTABILITY

Spinal instability of White and Panjabi is defined as "the loss of the ability of the spine, under physiologic loads, to maintain its pattern of displacement."[27, 28, 29]

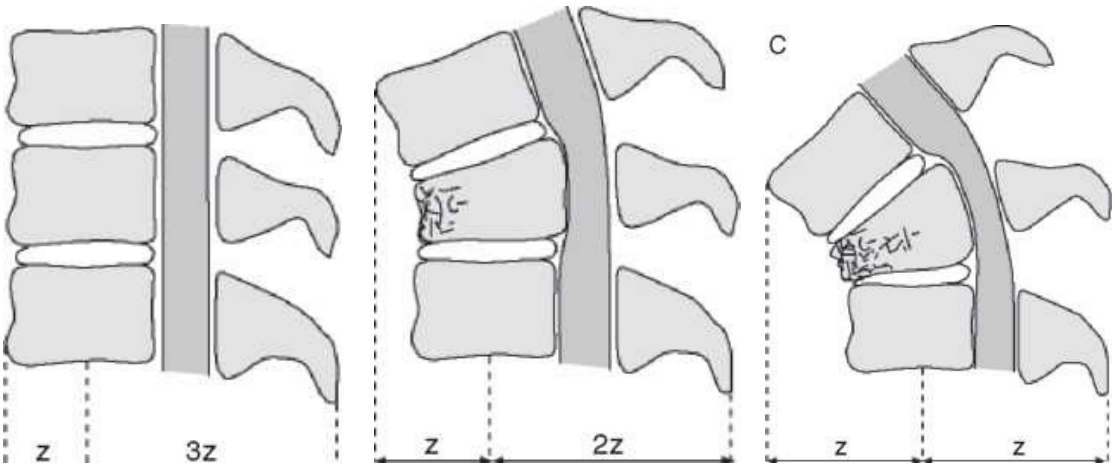


Figure 13- Biomechanical spinal loading and fracture.

(A) In normal spine the anterior lever arm z is acted on by the BW (body weight)

And it is counteracted by posterior column restraints at a lever arm 3z.

(B) In vertebral wedge Compression fracture, the anterior lever arm Z shows the relative increase, which causes relatively less counteracting force which results in further anterior compression.

(C) In osteoporotic vertebral wedge Compression fractured bones, this is further worsen by the fact that the fracture progresses to collapse further, which results in progressive increase in the anterior lever arm even more. Due to these, very less force is required to produce subsequent fractures and which ultimately causes a progressive kyphotic deformity.

FRACTURE CLASSIFICATION

Various classification systems are available to describe vertebral compression fractures.

Classification systems of vertebral compression fractures

- Denis[27]
- AO classification (Magerel)

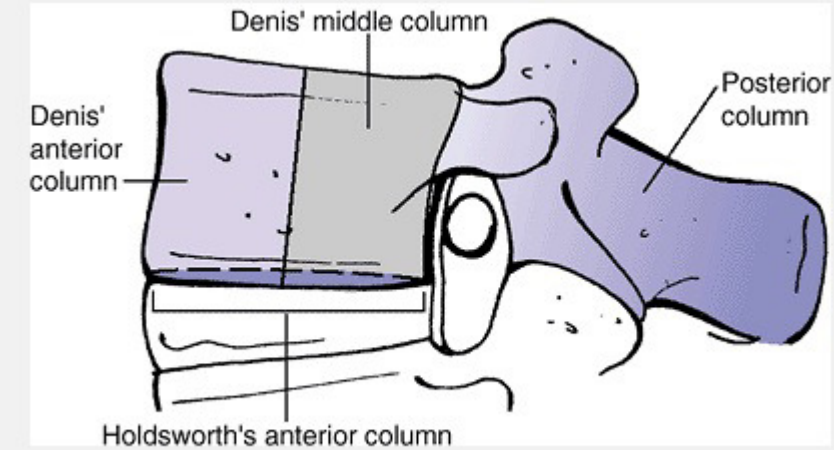


Figure 14 - Denis columns

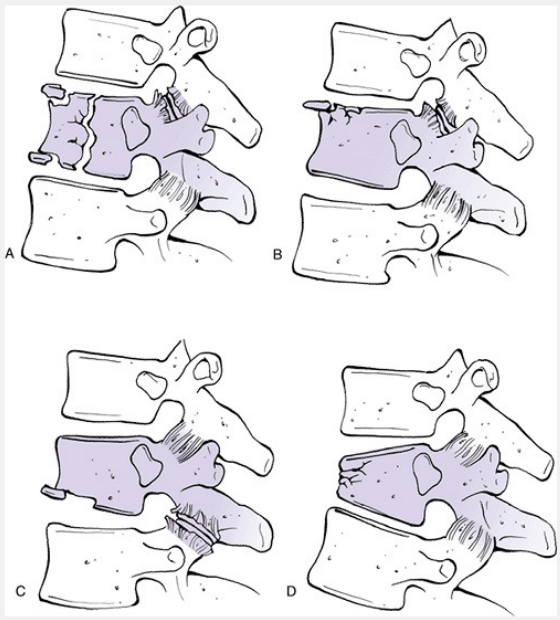


FIGURE 40-6 Denis classification of compression fractures. Type A involves both endplates, type B involves the superior endplate, and type C involves the inferior endplate. In type D fractures, there is a compression fracture of the anteriovertebral body.

Figure 15- Denis classification

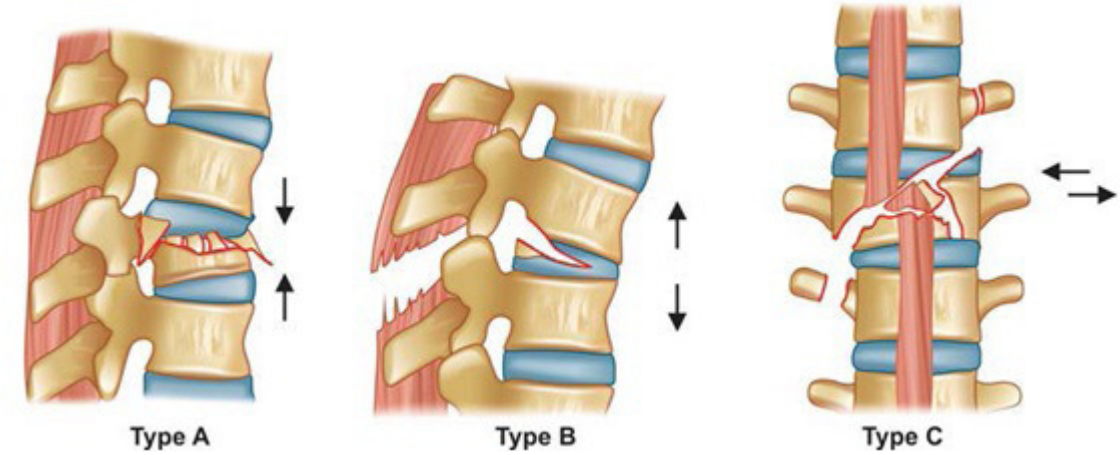
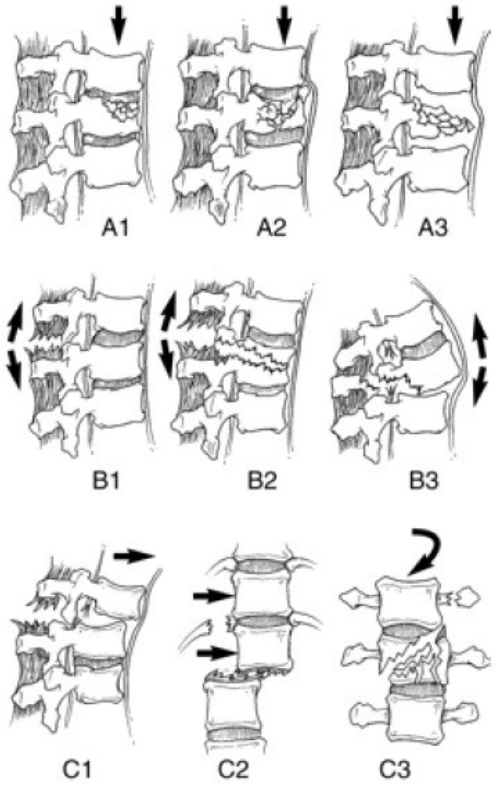


Figure 16-AO classification



Fracture types and groups within each fracture type in the AO/Magerl classification of spinal injuries. A = compression injuries: A1, impaction; A2, split; A3, burst. B = distraction injuries: B1, posterior, predominantly ligamentous; B2, posterior, predominantly osseous; B3, anterior, through the disk. C = torsion injuries: C1, type A with torsion; C2, type B with torsion; C3, torsional shear injuries

Figure 17- AO / MAGERL classification

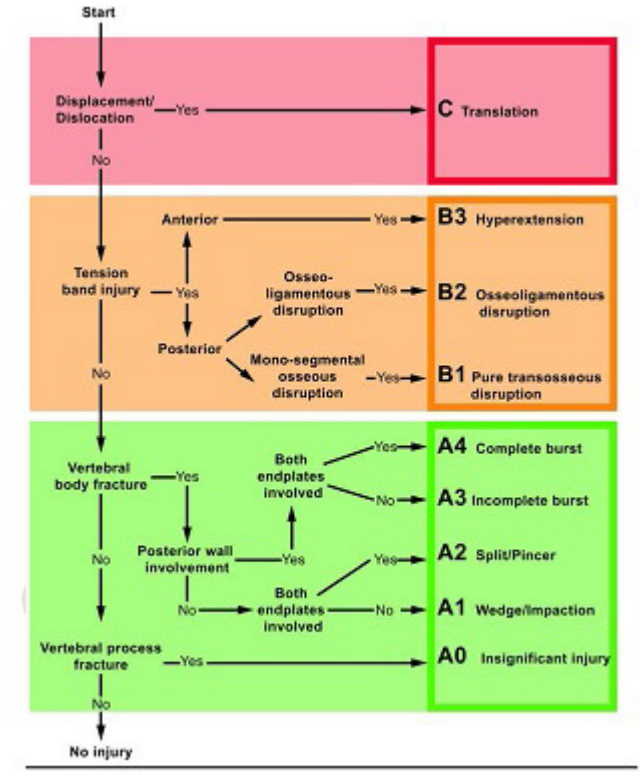


Figure 18 – AO classification Algorithm

Evaluating osteoporotic vertebral compression fractures by radiographic methods [31, 32, and 33)

The following methods are for evaluating osteoporotic vertebral fractures

1. Visual assessment,
2. Genant's semi-quantitative assessment,
3. Jiang's algorithm-based qualitative method,
4. Morphometric radiography, and
5. DEXA of the spine.

1. Subjective Visual Assessment:

In our daily practice of orthopaedics, subjective visual assessment of x-rays is the widely used and accepted method. This is essential for ruling out compression deformities of vertebrae due to other conditions. But the problem in this method is low reproducibility

2.Genant's semi-quantitative assessment:

It is based on the shape (concave, wedge or crush of the vertebrae) and also based on decrease in vertebral height, grading is done. Through this method spinal deformity index is calculated like the addition from T4 vertebrae grade to L4 vertebrae grades which reflects the severity of the fractures [(32)].

Thus increase in spinal deformity index correlates with at least 5% increase vertebral fracture risk at the end of 3 years. It helps in both diagnosis and prognosis of osteoporotic fracture which serves as tool for daily practice both for epidemiological studies and therapeutic trials.

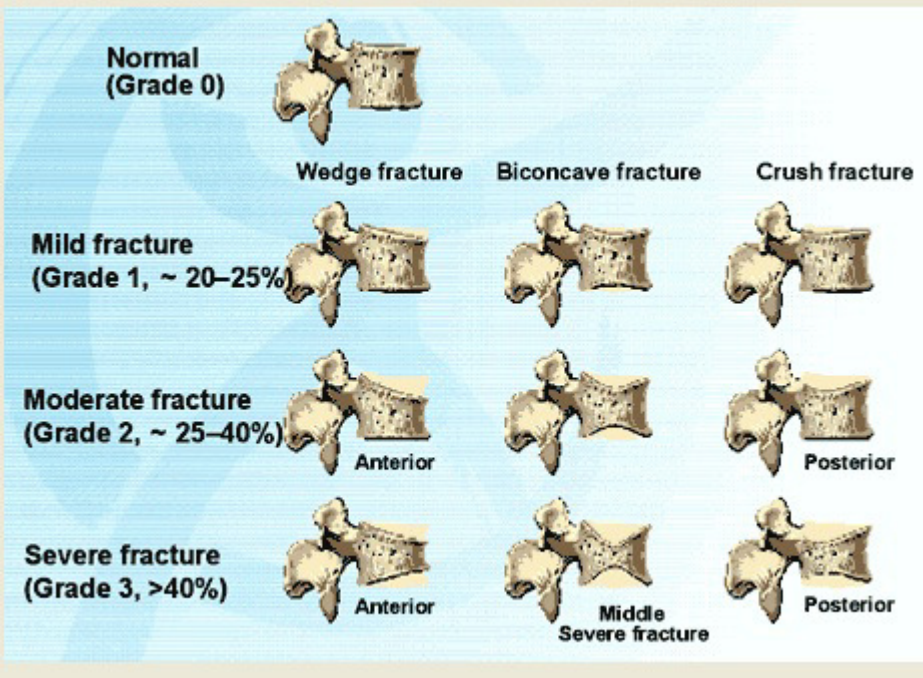


Figure 19- GENANTS Classification- semi quantitative assessment of Osteoporosis.

3. Jiang's algorithm based qualitative method:

It is based on the morphology (appearance) of the central endplate of the vertebra.

4. Morphometric radiography method:

Here digitalized x rays are used to evaluate the vertebral height both anterior (AVH), posterior (PVH), and middle vertebral body height (MVH).

5. Dual-energy X-ray absorptiometry assessment:

Vertebral morphology can be evaluated on lateral new generation dual-energy X-ray absorptiometry (DEXA) scans.

Table 2

Main features of five methods for evaluating osteoporotic vertebral fractures.

	Advantages	Disadvantages	Reproducibility	Use		
				Routine	Epidemiology	Therapeutic trials
Subjective visual assessment	Simple	Subjective	Poor	Yes	No	No
Genant's semi-quantitative assessment	Simple Proven to predict subsequent fractures Differential diagnosis	Training and experience needed	Very good	Yes	Yes	Yes
Jiang's qualitative assessment	Simple Differential diagnosis	Validation ongoing Not proved to predict subsequent fractures	Good	Yes	No	No
Morphometric radiography	Objective vertebral height measurement Proven to predict subsequent fractures	Tedious No differential diagnosis	Good	No	Yes If concomitant qualitative assessment	Yes
Dual-energy X-ray absorptiometry	Simultaneous BMD measurement Lower radiation exposure, lower cost	No differential diagnosis Thoracic vertebras poorly visualized	Fair	Yes	No	No

MEDICAL MANAGEMENT

Goal of the treatment is to achieve pain relief and combat osteoporosis. For pain relief start with NSAIDs, Opioids depending upon the pain tolerance and other co morbidities. Treatment goal of osteoporosis is further prevention of Osteoporosis. It includes adequate nutrition, weight bearing exercise, adequate Vitamin D & Calcium intake. If it fails then go for pharmacological treatment which includes

Pharmacotherapy[33,34]

1. Calcium – 1500mg /day in the form of Calcium citrate (21 % elemental Calcium) or calcium carbonate (40 % elemental Calcium).
2. Vitamin D (400-800 IU per day – treated with active metabolites 1,25Dihydroxy Vit D -3 (short half life < 4 hr and expansive) then changing into less expensive longer half life vit-D 2.

3. Hormone Replacement Therapy – combined estrogen with progesterone, SERM (Selective Estrogen Receptor Modulator) Raloxifene is commonly used than Tamoxifene.
4. Anti resorptive agents
    a. Bisphosphonates
        i. Binds to hydroxylapatite crystals of osteoclast and inhibits resorption.
        ii. 1st generation – Etidronate inhibit both resorption and bone formation approved for Pagets disease and hypercalcemia. (Not Osteoporosis)
        iii. 2nd & 3rd generation - Alendronate & Risedronate inhibit bone resorption 1000 times that of bone formation .So these are used in Osteoporosis. Zolendronate (5mg iv yearly) and Ibandronate are long acting (once monthly orally dosing)
        iv. Adverse events of bisphosphonates includes GI (same as placebo in studies), Flu-like “Acute Phase Reaction”, Bone pain, Hypocalcaemia, Iritis/Uveitis, Unusual subtrochanteric fractures.
    b. Calcitonin – 200 IU daily as nasal spray .it has an additional analgesic effect also.
5. Anabolic hormone – Daily low dosing of PTH (parathyroid hormone) & Teriparatide (PTH 1,34 – r) but has reported adverse events like Osteosarcoma in rats , Hypercalcemia 11% ,Dizziness 2.6%,Leg cramps 2.6%

6. Other agents like Sodium Fluoride, Strontium ranelate, Antiresorptive (anti-catabolic) also includes newer drugs like in trial are Denosumab (RANKL inhibitors), Odanacatib, and Oral salmon calcitonin.

PATIENT SELECTION

Pain attributable to the fractured vertebral level [36, 37, 38]. Local bony tenderness over spine

Detailed neurological examinations sensory and motor changes, radiculopathies
Laboratory tests: Routine blood investigations for cell count, diabetes tests and other tests for primary disease if any, causing the VCF is to be done- rays of spine in Antero-Posterior and lateral views. Preferably standing lateral view in flexion and extension views.

CT scan: The CT scanning with 3D, Sagittal and coronal reconstructions are helpful in assessing the complex vertebral fractures. Thin reconstructed sections show the fracture and the integrity of the posterior vertebral wall. CT with myelography is indicated particularly in cases where MRI is contraindicated [39, 40]

MRI: This is one of the single most investigations in the evaluation of the VCF. It has shown to be positive prognostic sign when bone marrow oedema or end-plate oedema is seen. This is seen in hours of the compression fractures. This is helpful to assess all the involved fracture levels, define the intervertebral clefts, and aid in giving information

about pathological fractures. High density signals on short-tau inversion recovery (STIR) or T-2 weighted sequences signify intraosseous oedema. Involvement of the pedicle or soft tissue or in epidural space may indicate malignancy or infection. Signal changes in vertebral body are predictive of high positive outcome with vertebroplasty [36-39].

STIR sequence is the most sensitive in identifying acute fractures and imaging modality of choice [40-46].

- Highly sensitive
- T2 acute fracture = oedema = increased signal
- T1 STIR T2

High intensity signal on STIR MRI has been shown 100% association with OVCF correction predictor for the vertebral body fracture correction.

SURGICAL OPTIONS FOR OSTEOPOROTIC VERTEBRAL WEDGE COMPRESSION FRACTURES

For the patients with failed conservative treatment with persistent painful fractures, less invasive vertebral augmentation (vertebroplasty) with PMMA bone cement is an excellent option. Numerous studies have shown that vertebroplasty result in significant pain relief for patients with osteoporotic painful fractures of vertebrae.

Osteoporotic Vertebral wedge Compression Fractures very rarely needs surgical stabilization [47-49]. The recommendation of stabilization depends on whether fracture is stable or unstable, and neurological deficit. Stable vertebral compression fractures are usually managed by conservatively by nonsurgical means. Unstable fractures & fractures with neurologic deficit may need surgical management [50]. Vertebroplasty woks based on chemical, mechanical, exothermic, decompression theories [51-55]. The Chemical ablation theory in which cements (PMMA) is chemo toxic to neurons of free nerve endings. It could be due to thermal theory in which heat generated during cement polymerization causes permanent damage to nerve endings of vertebral Nerve of fractured vertebrae. Other theories are mechanical theory i.e. mechanical stabilization restores the strength and stiffness of fractured vertebral body and decompression theory hypothesized that intra osseous pressure after fracture increases many folds which is decompressed by vertebroplasty [56, 57].

SURGICAL TECHNIQUE

Vertebroplasty in technique-wise appears simple [10, 11, 58]. One has to be highly cautious in every step or else end result may be disastrous. In well selected patients, vertebroplasty can produce excellent pain relief and is one of the most gratifying procedures.

Usually done in operation theatres. Some surgeons also do it in radiology department where CT guided vertebroplasty is done. The operation theatres set up should have continuous monitoring equipment of ECG, blood pressure, SP O2 and other vital parameters should be strictly monitored, and appropriate help including ICU setup should be available, if an emergency situation arises.

VERTEBROPLASTY NEEDLE (TROCAR-CANNULA SYSTEMS)

This needle utilized in vertebroplasty, and bone biopsies. As specific the Vertebroplasty needle assembly for injecting biological material or cementing material into the cancellous portion of bones [59-64].

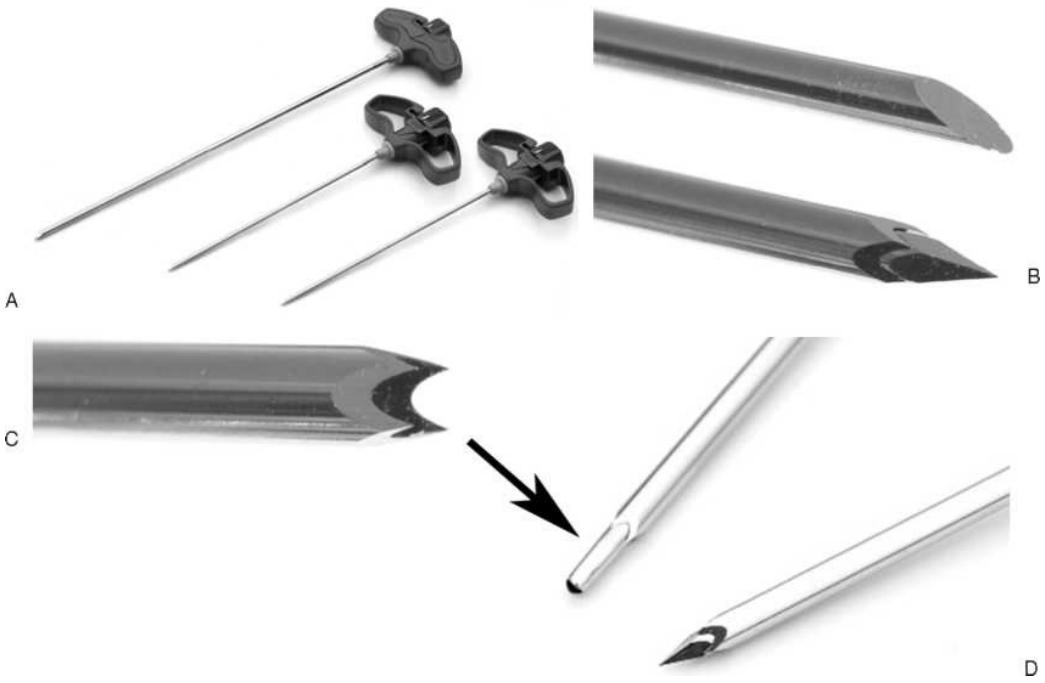


Figure 20- (A) Needle systems (Jamshedi or Cooks Needle) for PV used for cement delivery.

(B) Shows the needle points

(C) Shows the cannula with the trocar removed.

(D) Shows the pusher inside the cannula (black arrow), the trocar inside the Cannula

Advantages of this Needle Assembly

- The design gives better spread ability of the cementing materials and minimal time are required for the delivery of the cement.
- These needles at the top have fixed handle for the easy introduction of needle into the bone.

- The vertebroplasty needle posses a unique luer locking system at the proximal end, which can accept any syringe or cement delivery system available for injecting the cement.

This instrument assembly consists of

1. Long cannulated needle –the long needle has a central longitudinal lumen. A lure lock at the proximal end and a flanged tip
2. A trocar – have a diamond point which is match grounded with a very sharp tip that engages the bone surface easily and that prevents slipping during the start of needle entry. Through the long cannulated needle trocar telescopes till the open flanged tip of the long needle. The proximal end has a solid plastic cap which allows the hammering of the needle with trocar in the bone.
3. The pusher – which runs through the long needle telescopically till the end of the flanged tip of the long needle, and which actually pushes the cementing material into the bone cavity through the flanged tip end , ensuring FULL discharge of the cement.
4. Other uses ,is to obtain a bone biopsy

CEMENTING MATERIALS

Ideal cement would be:

- Highly visible on fluoroscopy.

- Cement should have bio-absorbable properties to allow bone growth to make a homogenous mass.
- The cement should be more viscous so that it does not easily leak.
- Cement hardening should occur with less heat.
- Cement should have more hardening time.
- Cement should not contain any allergens.

Over the decades the PMMA is used extensively in the skeleton as it has properties like biocompatibility with fewer allergies [65-69]. It is mechanically strong and if Barium or Strontium is added then it has good radio opacity [68-70].Being biologically inert, high temperature released during polymerization may damage the surrounding tissue, especially if it leaks into spinal canal which is its main negative point. Using cement at lower temperature or pre-cooled PMMA can increase the polymerization time i.e. setting time [70-72].

Calcium phosphate cements [CPC] which is shown to be biocompatible, biodegradable, osteoconductive and remodels to bone [65]. Calcium phosphate cement CPC also hardens in about 10minutes after mixing and the heat evolved is about 37 degrees centigrade. The cement also has maximum compressive strength at 1 week. Kim and colleagues have used novel bioactive bone cement consisting of

hydroxylapatite & PMMA cement mixture .Glass ceramic reinforced matrix component is also being developed for the Vertebroplasty.

No correlation was found between:

Volume of cement injected

Degree of vertebral body correction

Influence of Amount of Cement and degree of Fracture correction on pain

Degree of Fracture correction on pain.

POSITION OF THE PATIENT

With the patient in prone position the area to be operated spine can be visualized under C arm image intensifier. The anatomical landmarks of the vertebral body must be clearly seen.

MONITORING

'C' arm should be checked such that whether it is possible to give Anteroposterior, lateral and oblique views if required continuously during the procedure. All steps right from the positioning, needle placement, cement injections should be carefully monitored continuously throughout the procedure. It is most essential to have true AP and lateral views. The anatomical landmarks seen on anteroposterior view are superior and inferior endplates, the lateral borders of the vertebral body .The landmarks as seen on the lateral

view are: the anterior and the posterior vertebral borders, superior and inferior endplates, posterior aspect of the spinal canal and superior and inferior contours and borders of the pedicles. Identifying these landmarks one should be able to remove the parallax and one can have true views of the vertebra to be operated.

The pedicle margins in the AP view represents the waist or the narrowest portion of the vertebra .As the pedicle attaches to the vertebral body broadening or flare is seen, particularly in lumbar vertebrae [10, 58, 59].The trajectory of the needle entry can be decided upon the position of the waist additional information can be added by carefully reading the X-rays, CT scan and MRI scans. The spinous process and the site of the pedicles should be marked on the skin with the marker pen to serve as percutaneous reference points during the procedure

OPERATING TABLE :

Operating table should be radiolucent and can allow extension of the spine to achieve dynamic reduction wherever possible to restore the height of the vertebra.

POSITIONING :

The patient is rolled gently in prone position. Extreme caution during the positioning is essential to protect skin and the fragile osteoporotic bones. The extremities and the bony prominences should be well padded. Once positioned the imaging for the affected vertebrae should be seen very carefully. Use of skin marking pen can be made to mark entry points corresponding to the bony landmarks under ‘C’ arm.

Patient's comfort in prone position is the key. Arm rests near head of the table. Consider Foley catheter for lengthier, multi-level procedure .Follow strict sterile technique with full drape.

Identification of the pedicle margins under 'C' arm control is done. The entry points in the pedicle are at about 2 O' clock position in right pedicle and at about 10 O' clock position on the left pedicle and [10,58,64] Local anaesthesia is infiltrated over the skin till the periosteum of the pedicle to be operated, after identifying the vertebral level. Levels to be injected are marked and 2% lignocaine is infiltrated. Additionally intravenous sedation may be administered as per the requirement of the individual patient.

At some institutions general anesthesia, monitored anesthesia [midazolam, fentanyl] is also used depending upon the surgeon, anesthesiologist's experience, patient's condition and so on.

DRAPING AND PREPARATION

Localize symptomatic vertebral body levels prior to draping the skin

Choose approach, either

(1) Transpedicular – most common route

(2) Poster lateral (thoracic or lumbar spine)

(3) Parapedicular

After draping and preparation one can skin mark the site as per ‘C’ arm image intensifier guidance

Incision

Skin stab incision is taken suitable for insertion of the needle.

First, insertion of the vertebroplasty needle. The entry point is taken from the superolateral cortex of the pedicle. The insertion of the needle with trocar is done manually under fluoroscopy. Gentle tapping with mallet is done whenever necessary under fluoroscopy control. This takes the needle tip to preplanned trajectory, depending upon the transpedicular or extrapedicular approach planned. Major resistance is felt to the tapping hand is at the insertion at the pedicle, then at the posterior vertebral cortex.

In osteoporotic bone usually the needle can be gently passed with hand rotational movements without resistance.

One should be extremely cautions to avoid the penetration of the anterior cortex [58] (Figure 7). The medial and the inferior cortices of the pedicles are to be strictly avoided until the needle is totally inside the vertebral bodices. In lateral view monitoring of the needle placement is necessary depending upon the fracture anatomy and to avoid ventral penetration of the needle.

In AP view the needle tip should not penetrate the medial and inferior cortex into the vertebra body (Figure 7). In the extra pedicular approach the initially point is little

superior and lateral to the transpedicular entry point. And the final needle depth should be about 20 to 30% short of the anterior vertebral border.

Interosseous Venography:

It is necessary to have detail information of vascular pattern of vertebral body to anticipate problems during percutaneous vertebroplasty. Anatomical and pathological considerations in vertebroplasty and kyphoplasty are reappraisal of vertebral venous system.

In early cases vertebral venogram with urograffin non ionic contrast is performed before cement injection in order to detect any communication with a major vein [59, 60, and 61].

Position of Needle

Needle has advanced to the centre of a body or in the anterior one third of the vertebral body.

CEMENT PREPARATION

Steps of Preparation of Cement

Thorough mixing of the powder [polymer] and the monomer .this can be done in a bowl or in a mixing chamber.

Vertebroplasty cement is of surgeon's choice as per the indication of the vertebroplasty like high viscous PMMA or calcium phosphate vertebroplasty cement or any other is

prepared and the syringes filled and kept ready. Start injecting cement under c arm control, if one has any doubt about the intactness of the posterior wall of the vertebral body then stop injecting in the middle third of the body (36). Once the resistance is felt to the injecting hand carefully monitor the filling of the vertebral body do not apply high pressure to the piston of the syringe [71, 72].

The bone cement should be chilled overnight in order to prolong the working time. Operation theatre temperature should also be as low as per the instructions on the cement pack [68, 69]. This will allow more time for proper injection of the cement of the vertebral body.

With the adequate pressurization, cement should fill in the anterior body crossing the mid line to the other side and then the posterior side of the body. Every time the needle is completely filled with cement it is better to use cement pusher of the needle to empty the needle of the cement, it also prevents the cement leakage into the canal if pedicle breech is present. These will avoid the clogging of the needle and also allow the surgeon to know the exact amount of the cement injected in the vertebral body [68]. Keep the needle inside rotating till the cement sets, so that cement does not back flow in the pedicle are the canal [if the pedicle is broken] keep pressure dressing wait for few more minutes till the cement completely sets

Occasionally some cement that leaked outside the lateral cortex or that had gone through the superior endplates was observed. This usually occurs in those patients who suffered from superior endplate fracture; these leaks are of no major clinical importance.

When cement starts to fill the body behind the needle it is time to stop pushing bone cement in the syringe with the needle is turned two to three times to allow breakage of the cement column before it is pulled out. Unless the filling of the body is not satisfactory only one pedicle is usually used for injection .The needle should aim at the anterior third of the vertebral body [58].If required another pedicle can also be used for injecting the cement.

Once the outside cement is set, slowly remove the needle, under closed fluoroscopic observation. Do not allow the cement to spill along the needle track in the pedicle and soft tissue under the skin. Usually a small dressing is kept.

POSTOPERATIVE

The patient is advised to remain in bed supine preferably, for next 2-3 hours. Dressing at puncture sites. The patient is monitored continuously for:

Monitor vital signs. Temperature, pulse rate, falls in blood pressure. Some patients may develop fever as a reaction to cement (chemical) but is usually self-limiting and can be treated with antipyretics.

Monitor neurological examination: Essentially look for motor, sensory symptoms developing for fresh segmental postoperatively. Also observe for fresh segmental neuralgia. If present, it may indicate nerve too irritation by the cement at the neural foramen.

Strict bed rest for 2-3 hours prior to discharge and Supine position for 1 hour

Post discharge instructions-Gradual increase in activity over 3 days. Patient may take analgesics: Attempt to decrease dose and frequency. Patient instructed to call for Lower extremity weakness, Fever >38.5 C, new back pain and chest pain.

- Follow up X-rays are done: In immediate postoperative method and later on to assess the progress after 1 month and 3 months.
- Postoperative follow up X-rays 3 months (A.P/ Lateral views).
- Long term follow X-rays are done after 1 year or earlier if the patients symptoms suggest need for the tests

COMPLICATIONS

Medical, Anaesthesia, Instrument Placement, PMMA Cement Related

Literature search gives the figures of about 1.3% of complications reported with osteoporotic fractures and about 2.5% with malignancies or metastatic disease [(73)]. Complications mostly are transient and can be managed by expectant management and NSAIDs.

As with percutaneous procedures, local skin infection can be avoided by proper painting and draping and meticulous skin preparation [73, 74]. Observe strict sterile technique.

Rib fractures may occur if downward force is applied in a prone patient, who is severely osteoporotic, on patient's chest wall during the needle insertion [73-76]. Intercostal neuralgias may be treated by analgesics or nerve root blocks.

PMMA Cement Related

Cement leak is one of the commonly seen problem and in one of series it is reported the very high 70% in malignant VCFs. The Cement leak may occur in the needle tracts, intervertebral discs, soft tissues nearby, in epidural veins, IVC rarely in pulmonary veins and can cause death [74-81].

Development of neurological complications is dependent on many things like size of spinal canal, amount of leak, proximity of the neural structures, and volume of the cement [74]). The operating surgeon should identify the cement leak at the earliest in biplanar fluoroscopy and minimize the leak and reduce complications [74, 75].

MATERIALS AND METHOD

This prospective study was conducted in Govt. Royapettah Hospital, Kilpauk Medical College in the 'Department of Orthopaedic Surgery', from March 2012 to December 2013. Ethical committee approval for the study was obtained. Patients with wedge compression fractures are admitted and treated with Vertebroplasty.

INCLUSION CRITERIA

- Painful vertebral compression fracture > 1 month old, refractory to conservative treatment with intact posterior cortex.
- Kyphosis > 20 degree
- Chronic painful Vertebral fracture with Non union
- Kummel's disease
- Vertebral Compression Fracture >40% collapse.
- Malignant vertebral tumors (Metastasis / Myeloma)
- Vertebral hemangiomas

EXCLUSION CRITERIA

- Responding to conservative treatment
- Local / systemic Infection
- Coagulopathy
- Posterior cortex breach
- Cord compression

- Neurological Deficit
- Vertebra plana
- Collapse >80%

A total of 35 patients were taken up in the study during the above mentioned period. The age of the patient was in the range of 52 -80 years. There were 13 males and 23 females in this study. Two patients had associated injuries which were managed and they did not influence the functional outcome.

On presentation in outpatient department true Anterior – posterior and true Lateral views X-rays of injured spine were taken &vertebral wedge compression fractures diagnosed. Baseline demographic and injury characteristics were noted. Patient's vertebral wedge compression fractures were classified according to the Denis Classification managed conservatively for 4 weeks with analgesics and brace.

The patients with osteoporotic compression fracture were initially treated conservatively and later presented with persistent intolerable low back pain, with or without radiating pain, all without any neurological deficit and inability to do daily activity of living. These patients were admitted through outpatient department.

After admission a detailed history from the patient were obtained ,which includes name and age of the patient ,date and time of injury ,mode of injury , initial treatments and his/her present complaints were noted. Any history suggestive of other illnesses to rule

out causes for compression fractures and associated co morbid diseases were noted and taken care of.

Then patient was examined thoroughly and attention given to examination of spine like any local swelling, deformity, tenderness over the spine was noted.

Neurological chart which included assessment of motor status, sensory status bowel & bladder status were noted. According to neurological status, Frankels grading was derived. This was done for the purpose of comparison of post operative neurological status .In all patients, Pre operative Visual analog score for back ache, Oswestry disability score &Oswestry disability index were noted for the purpose of comparison of post operative functional outcome.

Patients were investigated with Chest X-Ray, ECG, CBC, RFT, Random Blood Sugar, and Blood Grouping & Typing, which were required to get anesthetic fitness for the procedure. Other investigations like Serum Calcium, LFT, ALP, Acid phosphatase, Serum Electrophoresis, Urine Bence Jones Protein were done to evaluate the cause of fractures.

Radiological evaluation was done in all patients. Fresh X-ray spine Antero posterior view & lateral view spine were taken, if needed dynamic x ray –flexion / extension lateral view were taken to rule out spinal instability based on white Punjabi score. Specific findings were sought for integrity of anterior, middle, posterior column of spine.

Level of fractures, type of fracture, Angle of kyphosis and anterior vertebral height were noted as it will be helpful in considering type of intervention and for further follow up.

The Computer Tomography CT scan done and found to be accurate form in assessing the nature of fracture details like level of fracture, type of fracture ,presence of posterior cortex breach, percentage of collapse, fracture involvement of superior and inferior endplate ,percentage of spinal canal compromise, presence of bony fragment pressing upon the cord, any pedicle fracture and morphometry . All these factors were assessed as a part of preoperative evaluation to avoid per-operative complications.

Magnetic resonance imaging (MRI) scan done in few cases to assess the age of the fracture , Anterior and Posterior longitudinal ligament breech and any marrow and spinal cord changes..

Subsequently patient and the attendants were explained about the nature, severity, progression, prognosis of injury along with the proposed line of operative management, Vertebroplasty its advantages & complications.

All patients accepted our proposed management and underwent Vertebroplasty.

ANAESTHESIA – INTRAVENOUS SEDATION

In all the 35 cases moderate IV sedation was given. Cardiac and respiratory monitoring done per operatively. Pre-op test dose of the anaesthetic drugs, injection TT, dye

urograffin and antibiotic given .Prophylactic broad spectrum i.v antibiotic injection Cefotaxime 1 gm was given in all patients before half an hour of surgery

SURGICAL PROCEDURE

The procedure was performed in the elective operation theatre by one surgeon and two assistants. The patient was prepared in the ward in the morning on the day of surgery .A Radiolucent and image intensifier compatible operating table was used. An indwelling Foley's catheter was maintained during surgery. The patient was positioned prone; the area to be operated was visualized under C arm image intensifier.

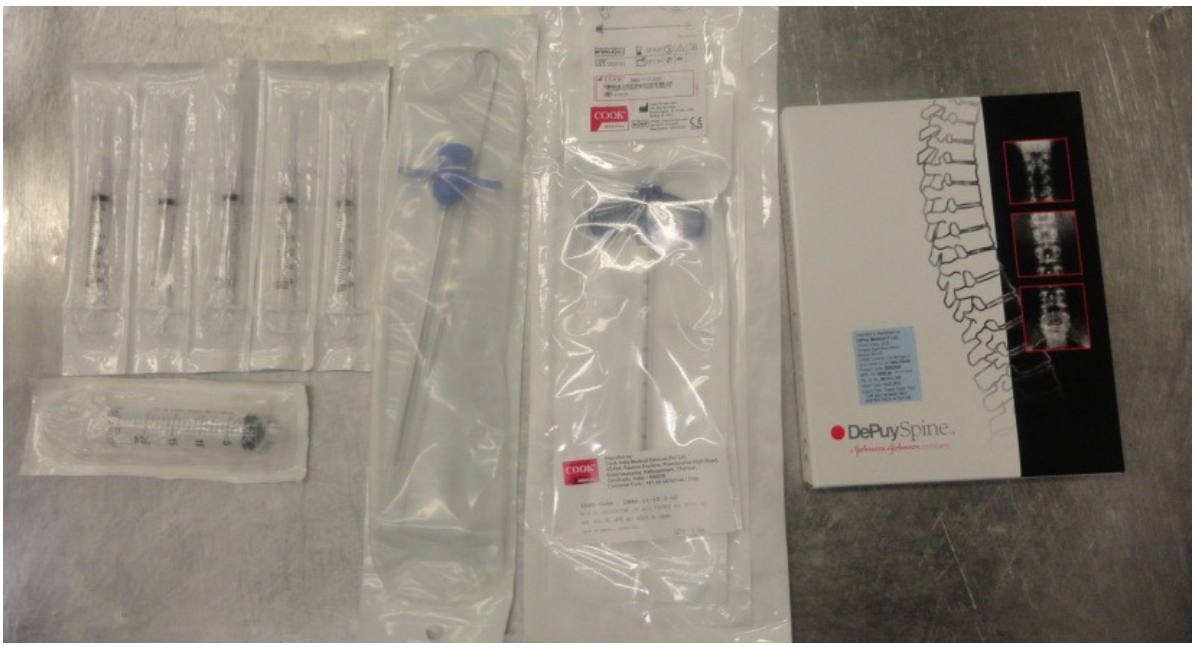


Figure 21- Vertebroplasty Tools

MONITORING

'C' arm was arranged such that Anteroposterior, lateral and oblique view could be taken if required during the procedure. Using marker pen, level of the fracture was marked under C- arm control. Area to be operated was painted using povidone Iodine and draped After Intravenous sedation , 20ml of lignocaine with adrenaline was infiltrated over the proposed site of operation.Under image intensifier we located the pedicle percutaneously, a small incision was made lateral and superior to the cutaneous pedicle location which allowed proper convergence through the tissues to the proposed pedicle entry point. Using Vertebroplasty Cook's needle of size 11gauge /15cm entry point was made at 10'o clock position on the lateral border of pedicle and switched c-arm to the lateral view to verify trajectory of needle & position. Through transpedicular approach

needle was placed into the body at the junction of posterior two-third & anterior one-third of vertebral body which was confirmed in the lateral view.

INTRAOSSEOUS VENOGRAPHY:

Now the needle was removed keeping trocar in situ in the vertebral body. Non Ionic Contrast Sodium Diatriozoate Meglumine (urograffin) was injected slowly under constant image intensifier guidance. This was done to detect any direct communication of needle tip with intra osseous vascular system of vertebral body and any extraosseous leakage of dye by which peroperative complications were tackled.

CEMENT PREPARATION & CEMENTATION:

Vertebroplasty PMMA Cement (available in 22gm /25 gm pack) was prepared in separate bowel and five 3ml syringes were filled and kept ready. Once it became tooth paste like consistency and after Rat tailing, we injected cement slowly into vertebral body under C-Arm Control.

Once we felt the resistance syringe was removed, cement pusher was used to empty the cement in the trocar. Once the outside cement was set , trocar was removed slowly under C Arm control otherwise cement would spill along the needle track in the pedicle and soft tissue so called Lolly – pop sign will occur. Sterile dressing at the puncture site done, intravenous sedation was cut off. Patient was turned into supine from prone and advised to remain in bed supine preferably for next 2-3 hrs.

POST OPERATIVE PROTOCOL:

Patient was monitored for vital signs, thorough post op Neurological examination done and asked for pain relief soon after procedure.VAS score ODS score& index were recorded.

We routinely use intravenous antibiotics Inj.Cefotaxime 1 gm i.v B.D for two days. Standard AP and Lateral radiographs were taken to see whether cement was confined to the body, any extravasation of cement into adjacent structures, post op kyphotic angle and any restoration of vertebral height. Then Patient discharged after 48 hrs and was advised to take oral antibiotics Tablet Cefixime for three more days, Tablet Tramadol / Tablet Diclofenac along with Tablet Pantaprazole for residual pain for seven days along with that tablet Calcium 1 gm for one month, Tablet Bisphosphonates /Nasal spray calcitonin in affordable patients. Patient was advised to gradually increase the daily activities of living over 3 days. Patient was instructed to call for new back pain, Chest Pain, Lower Extremity weakness, Fever > 38 any other medical illness as a part of follow up.

Patients were followed up at 1 month,2 month,3month,6 months and 1year and then at every 6 months as long as possible. Each time patient was assessed clinically with the Pain score – Visual analogue scale, Oswestry disability score & index and radiologically.

OBSERVATION AND ANALYSIS

TABLE 1: AGE DISTRIBUTION

In our study we had mean age of 61.42 years with youngest case of age of 55 years and oldest case of age 80 years.

AGE	MALE	FEMALE	TOTAL NO OF CASES
51-60	0	12	12
61-70	11	9	20
71-80	2	1	3
TOTAL	**13**	**22**	**35**

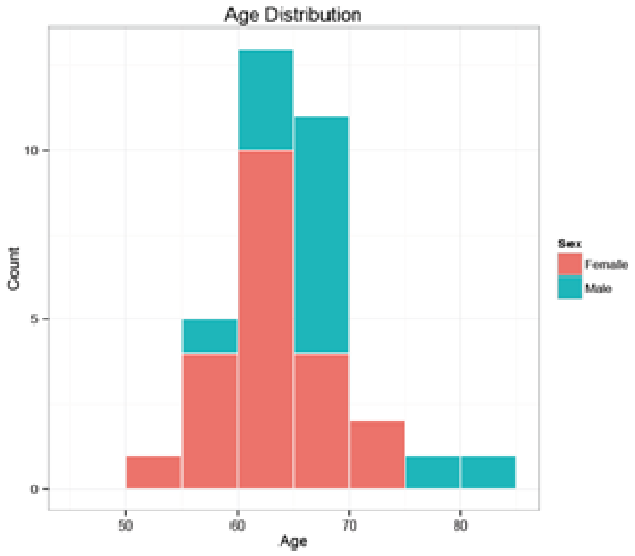
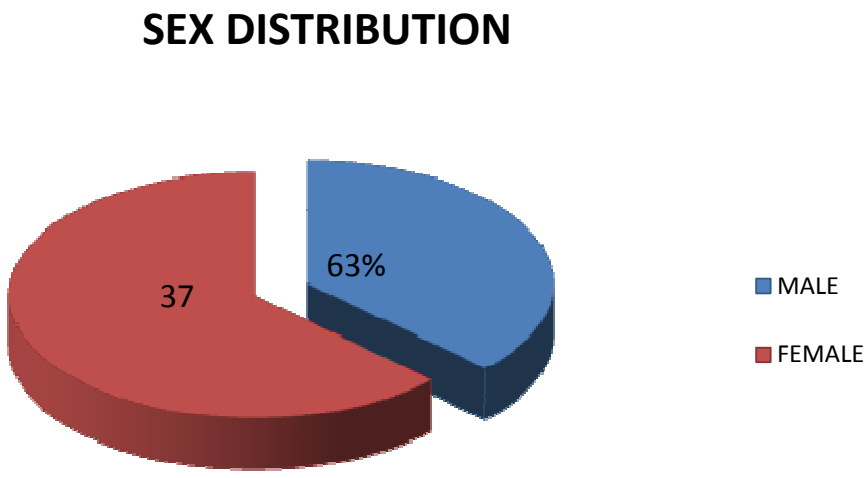


TABLE 2: SEX DISTRIBUTION

Sex	CASES	
	No	**Percentage**
MALE	13	37%
FEMALE	22	63%
Total	**35**	**100**



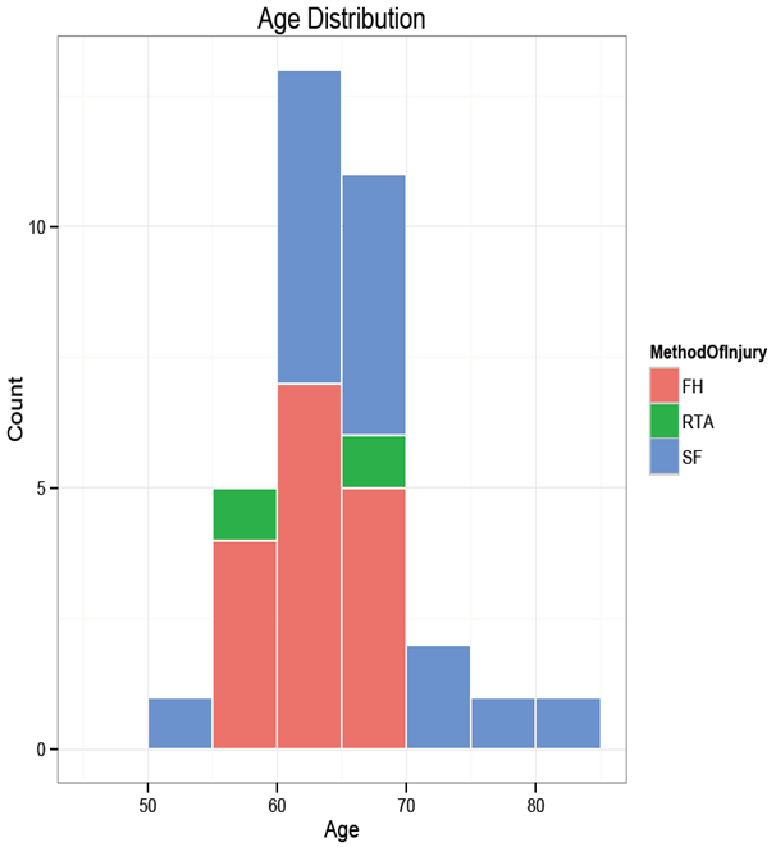

Age Distribution
Count
10
5
0
50
60
70
80
Age
MethodOfInjury
FH
RTA
SF

TABLE 3: VERTEBRAL LEVELS

Vertebral level	NO
D11	2
D12	12
L1	10
L2	8
L3	4
L4	3
L5	1
TOTAL	**40**

CO-MORBID CONDITION:

12 cases had associated co morbid conditions out of which 9 had Diabetes Mellitus, one case had chronic liver disease, one case had Parkinsonism, and one case had Coronary Artery Disease.

TABLE 4: DENIS COMPRESSION FRACTURE – CLASSIFICATION:

FRACTURE TYPE	CASES	
	NO.	Percentage
A	-	
B	20	54
C	2	6
D	13	40
Total	35	100

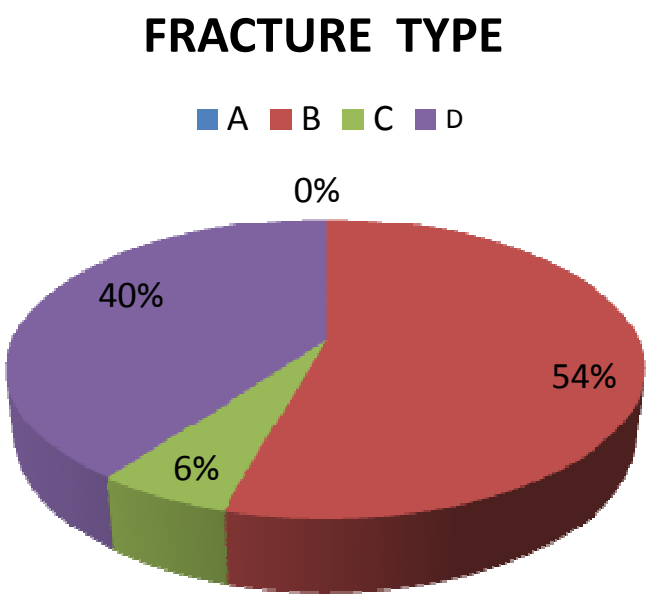


TABLE 5: AO CLASSIFICATION:

We classified them according to AO classification.

AO TYPE	CASES	
	NO	PERCENTAGE
A1	21	57%
A2	14	43%
A3	0	0%

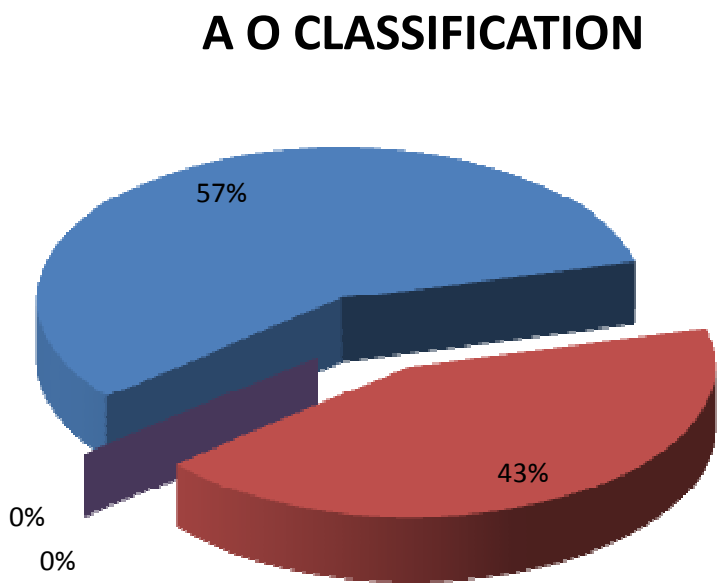
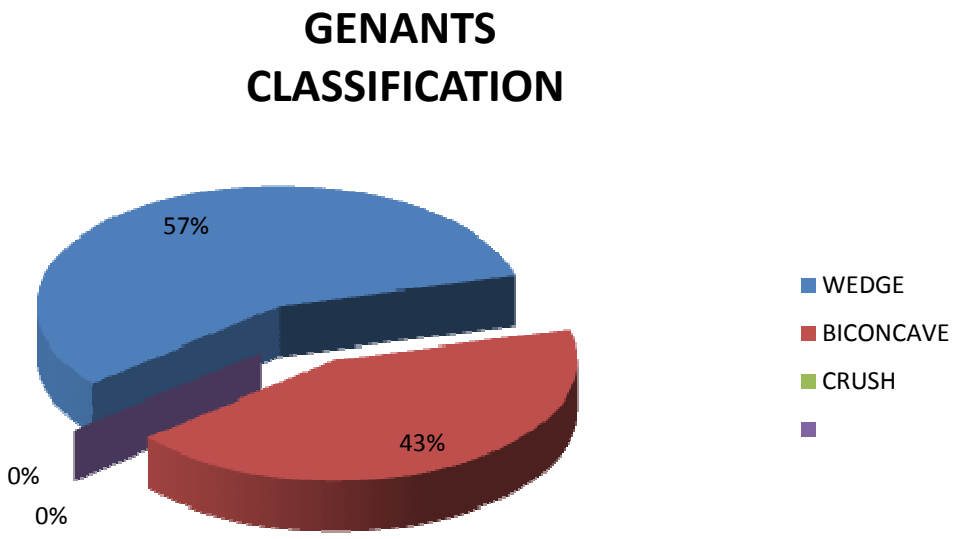


TABLE 6: Osteoporotic vertebral Wedge compression fractures - GENANT'S CLASSIFICATION

We classified them according to GENANT'S CLASSIFICATION.

SHAPE	CASES	
	NO	PERCENTAGE
WEDGE	21	57%
BICONCAVE	14	43%
CRUSH	0	0%



ASSOCIATED FRACTURE:

4 cases had associated fractures. 1 case had associated Intertrochanteric fracure, 1 case had fracture Calcaneum, and 2 cases had distal Radius fracture

FUNCTIONAL OUTCOME

TABLE 7: PRE-OPERATIVE VAS VS POSTOPERATIVE VAS

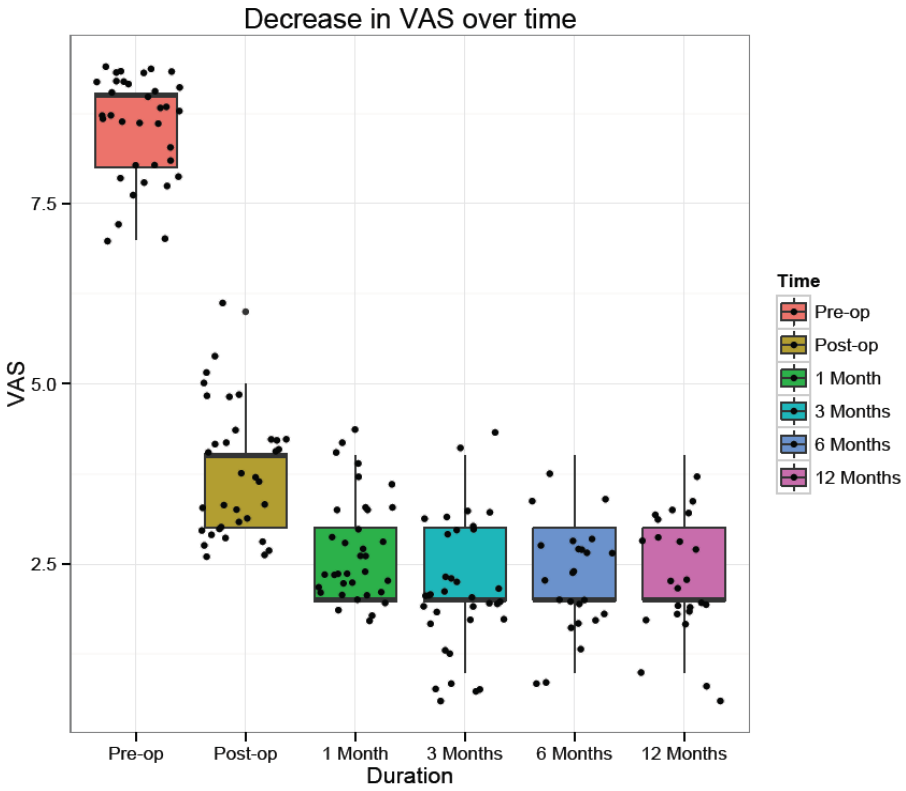


TABLE 8: PRE-OPERATIVE ODS (OSWESTRY DISABILITY SCORE) VS POSTOPERATIVE ODS OSWESTRY DISABILITY SCORE)

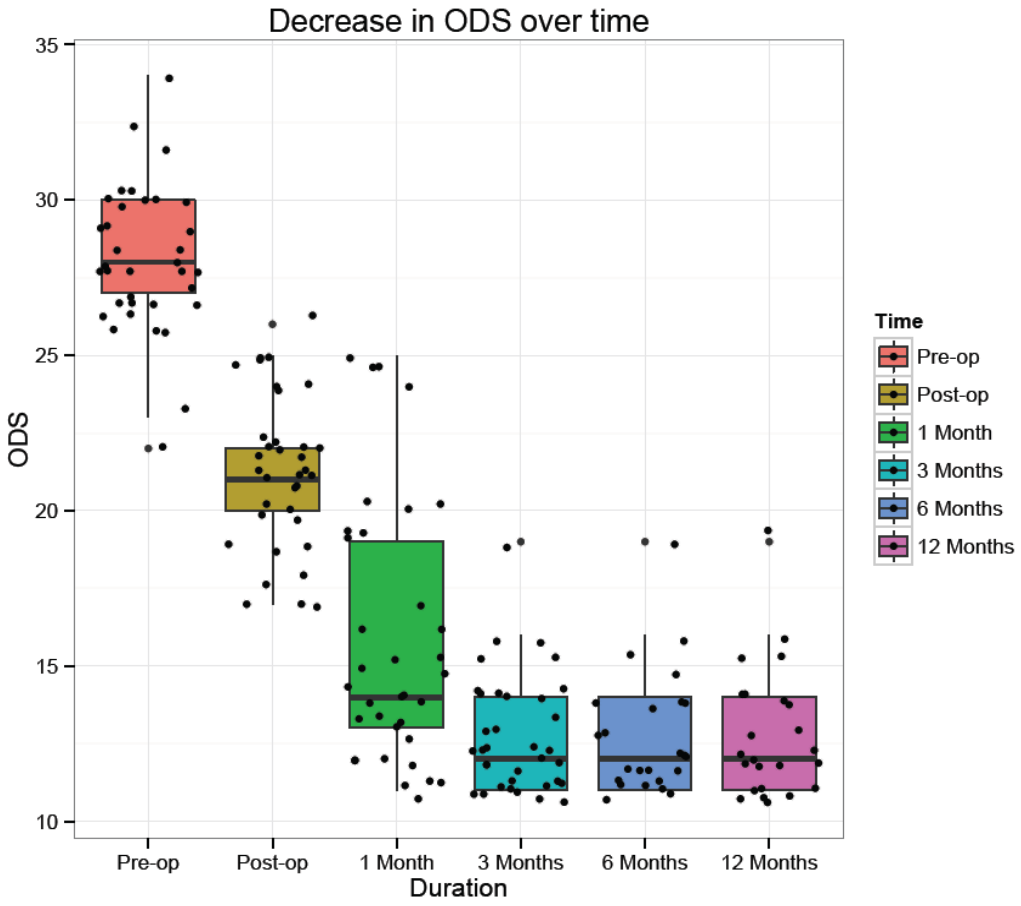


TABLE 9: PRE-OPERATIVE ODI (OSWESTRY DISABILITY INDEX VS POSTOPERATIVE ODI OSWESTRY DISABILITY INDEX)

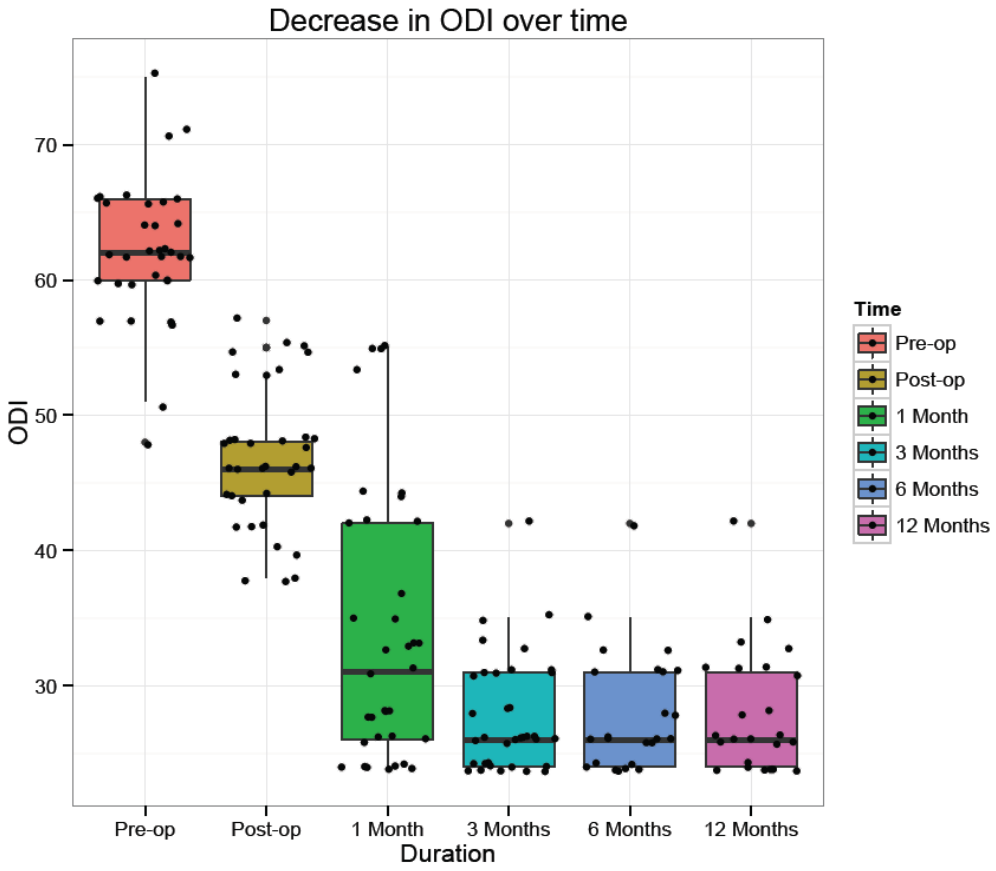


TABLE 10: COMPLICATIONS

In our study we had no complications in 30 patients, minor complications like asymptomatic cement extravasations in one patient, lloly pop sign in 2 patients,

venous leakage in 1 patient, adjacent level fracture in 1 patient and no major complications

COMPLICATION	CASES	
	No.	IN %
NIL	30	86%
MINOR	5	14%
MAJOR	NIL	0%

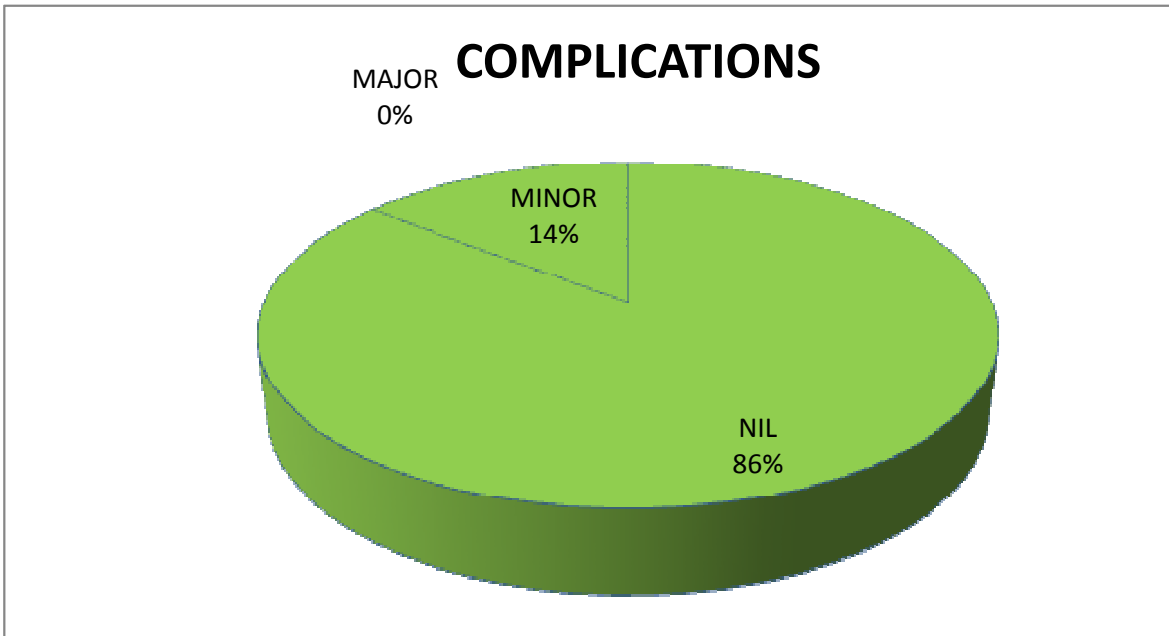


TABLE 11: TYPES OF COMPLICATIONS

Minor cement extravasations into soft tissue	2
Minor cement extravasations into spinal canal	0
Minor cement extravasations into venous channe intraoperatively	1
Dye leakage	5
Adjacent level fracture	1
Lolly pop sign	2
Major paraplegia	Nil
Major cement embolism, rib fracture	Nil

RESULTS

In our study, 40 Patients with osteoporotic vertebral wedge compression fracture were treated with Vertebroplasty. Out of 40 patients 5 patients were lost for the follow up and they were excluded .Hence 35 patients were considered for the analysis.

Average follow up was done for 8 months with maximum follow up was for 18 months and minimum follow up was for 3 months. There were 27 cases with more than 6 months of follow up and 11 cases with more than 12 months follow up.

STATISTICAL ANALYSIS

The comparison test employed is “Wilcoxon signed rank test with continuity correction" for PAIRED DATA. The results are given in terms of p-value, 95% Confidence Interval & Pseudo Median (estimated benefit from the intervention). The comparison test employed is “Wilcoxon rank sum test with continuity correction" for UNPAIRED DATA the results are given in terms of p-value. The comparison test employed is "Kruskal-Wallis rank sum" for UNPAIRED DATA GROUPS the results are given in terms of Kruskal-Wallis chi squared value & p-value. The correlations are all called using LINEAR REGRESSION. The results are described with adjusted R-squared statistic, F-statistic, p-value.

FUNCTIONAL OUTCOME PAIN RELIEF

Advantages of Vertebroplasty are fast, reliable and effective pain reduction which was assessed by Visual Analog Score scores.

VAS	IMM POST OP	ONE MONTH	THREE MONTHS	SIX MONTHS
V value	630	630	630	630
P VALUE	1.936e-07 (Highly Significant)	1.924e-07 (Highly Significant)	2.05e-07 (Highly Significant)	2.0e-07 (Highly Significant)

95 percent confidence interval	4.5 to 5	5.5 to 6.5	6 to 7	6 to 7
Pseudo median of sample estimate	5	6	6.5	6.5

This statistics comparing preop VAS score versus VAS score at immediate, one month, three months, six months from which we interpreted that p value < 0.0001 in all postoperative period, so it was a significant comparison. Statistically, we got significant pain relief in immediate post operative period which was maintained at the end of 6 months also.

REDUCTION IN PAIN MEDICATION

A significant reduction in analgesic intake was revealed. The patients without any analgesics increased from 0.5% (n=2) pre operative to 85.7% (n=30) at the six months follow-up (P less than 0.0001).

SEGMENTAL KYPHOSIS EVALUATION

For the evaluation of the segmental kyphosis (in terms of vertebral height) and alignment, 35 patient's x-rays were radiologically assessed.

The average Beck index (anterior vertebral body height divided by posterior vertebral body height) pre-operative was 0.83, the immediate post-operative average Beck index was 0.84.No significant increase in height.

Analysis of other factors influencing functional outcome Pain relief .In our study we statistically analyzed various other factors influencing pain relief in terms of VAS score.

FACTORS	VAS score
AGE	Coefficients: (Intercept) VAS change 72.61 -1.45

	F-statistic: 2.46 on 1 and 32 DF, p-value: 0.1266 Adjusted R-squared: 0.04238, Multiple R-squared: 0.0714,
SEX	W = 115.5, p-value = 0.3393
MODE OF INJURY	Kruskal-Wallis chi-squared = 1.7652, p-value = 0.4137
DAYS TO INTERVENTION	Coefficients: (Intercept) VAS pre 39.329 1.755 F-statistic: 0.08938 on 1 and 33 DF, p-value: 0.7668,Adjusted R-squared: -0.02752 Multiple R-squared: 0.002701,
OCCUPATION	W = 159.5, p-value = 0.7558
COMORBIDITIES	W = 131, p-value = 0.684
DURATION OF SURGERY	Coefficients: (Intercept) Duration Of Surgery 6.248074 0.003852 F-statistic: 0.0224 on 1 and 33 DF, p-

	value: 0.882,Adjusted R-squared: -0.0296 Multiple R-squared: 0.0006782,
CEMENT VOLUME	Coefficients: (Intercept) VAS change 2.55528 0.01585 F-statistic: 0.04889 on 1 and 33 DF, p-value: 0.8264 Adjusted R-squared: 0.02878 ,Multiple R-squared: 0.001479,
VISCOSITY OF CEMENT	W = 131, p-value = 0.684
CEMENT SETTING TIME	Coefficients: (Intercept) Cement Setting Time 6.6950 -0.0172 F-statistic: 0.018 on 1 and 33 DF, p-value: 0.8941,Adjusted R-squared: -0.02974 Multiple R-squared: 0.0005451,

Pain relief statistically analyzed with age it showed that VAS score i.e. pain relief seems to be decreases as age increases but the correlation was not statistically significant (p value - 0.1266).

In our study, pain relief in terms of VAS score was compared with sex, occupation ,mode of injury, time to intervention , co morbidities , cement setting time, cement volume and viscosity statistically results showed that none of the above factor is significantly correlated with the outcome pain relief (all P value were > 0.05 statistically insignificant) ,so these are independent factors.

FUNCTIONAL OUTCOME - QUALITY OF LIFE IMPROVEMENT

Quality of life improvement assessed based on Oswestry Disability score ODS and Oswestry Disability index ODI .The results were

Oswestry Disability Score	Immediate postop	First Month	Third Month	Six Months
V	630,	630,	630,	630,
p-value	2.39e-07 (Highly Significant)	2.487e-07 (Highly Significant)	2.424e-07 (Highly Significant)	2.424 e-07 (Highly Significant)
95 percent confidence	6 to 7.5	11 to 14	14.5 to 16	14.5 to 16

interval Pseudo-Median of Sample Estimate	7	12.5	15.5	15.5

Oswestry Disability Index	Immediate postop	First Month	Third Month	Six Months
V p-value 95 percent confidence interval Pseudo-Median of	630, 2.44e-07 (Highly Significant) 13.5 to 17 15.5	630, 2.532e-07 (Highly Significant) 25.5 to 32	630, 2.45e-07 (Highly Significant) 32.5 to 36 34.5	630, 2.45e-07 (Highly Significant) 32.5 to 36 34.5

Sample Estimate		29		

This table showed that preoperative ODS & ODI versus Post operative ODS & ODI at immediate, one month, three months, six months. The results interpreted from this table showed that p value < 0.0001 in all postoperative periods, so it was a statistically significant correlation and comparison. It means that quality of life have been improved significantly in immediate post operative period which was maintained at the end of 6 months also .Vertebroplasty increases the quality of life considerably.

CEMENTED LEVELS—FRACTURED LEVELS

Vertebroplasty done in 38 osteoporotic vertebral bodies. The most frequently treated levels were D12 of cases.

Of the 38 cemented vertebral levels, fracture-36 (94%).one case of multiple myeloma compression. Prophylactic Vertebroplasty was not done at any level.

DIFFERENT CONDITION

We have done Vertebroplasty in wedge compression fracture of different condition like Multiple Myeloma in one case. We found no significant post operative pain relief and patient died two months later so patient was excluded from our study.

ADJACENT FRACTURES

In our study only one patient developed adjacent cranial vertebral fracture which was found during follow up at the end of first month. Since patient not complained any new pain we treated him conservatively.

CEMENT EXTRUSIONS

We observed paravertebral soft tissue in one case, para-vertebral vessels in one case, needle track extrusion(lolly pop sign) in 2cases ,along Anterior longitudinal ligament extrusion .Cement extrusions has not caused any neurological deficit and radiculopathic symptoms.

INTRAOPERATIVE COMPLICATIONS

In cirrhotic patient with massive ascities who had hypotension even before cement injection and it was managed intraoperatively with ionotropes and crystalloids .We have not encountered any severe complications like shock, paraplegia, and cement embolism into systemic circulations.

DISCUSSION

Our study reports short-term functional outcome in the management of osteoporotic wedge compression fractures with vertebroplasty. Vertebral fractures are associated with restricted mobility which leads to decreased quality of life, and increases risk for future fractures, and ultimately these morbidity ends up with mortality. [5, 6, 7]

Now Vertebroplasty type of vertebral augmentation procedure is accepted as a one of the most important and cost effective minimally-invasive treatment in these fracture management. In the last decade, a multiple studies have done and proven the reliability, efficacy, safety and cost-effectiveness of this treatment. [6, 7, 10, 11, 12]

In our study, we found a marked reduction in low back ache which is clinically as well as statistically significant in terms of reduced analgesic intake, and marked increase in quality of life.

Our study has showed minimal cement extrusion rates when compared to other studies it was a much lesser asymptomatic cement extrusions. [58, 59, 64] No additional prophylactic vertebroplasty of adjacent and nonadjacent vertebral bodies was done as preventive measure of further future fractures.

In our study, we encounter one case with adjacent fracture whereas in the literature, percentage of adjacent level fractures varies between 17% and 27% and it also varies with the follow-up time. Unfortunately objective factors not yet established which is

useful for assessing the risk of individual fracture and also the most susceptible levels [94, 5].

McGraw and colleagues studied results from 135 venographies in 96 vertebroplasties provided useful information for PMMA flow characteristics [86

The study by Gilula et al said that the contrast material may interfere with visualization of the cement. Author prefers venography for a very vascular zed lesions [95]. E.g. A-V malformation, hypervascular metastasis.

In literature, intra op hypotension due to cement monomer component were given .In our study , intra-operative hypotension was observed in one patients with other co-morbidities which were monitored very closely and revived ,compared to other studies where 5 % associated with hypotension due to monomer of cement.

We don't have much improvement in the Beck index. Whereas Balloon Kyphoplasty has shown the ability to restore and increase in vertebral body height and Becks index which improves the alignment than vertebroplasty [4, 71].

A significant back pain reduction in immediate post operative, maintained at the end of 12 month which was measured using VAS score. The pain reduction is significant and it is relevant clinically. It also reveals the fact that the pain relief, reduced the need for analgesics, and increased the Quality of life after Vertebroplasty to a great extent.

In One patient with multiple level wedge compression fracture both with old and new was treated with vertebroplasty and posterior stabilization. In another patient with >50% compression, initially Vertebroplasty was done but patient has persistent pain so we done posterior stabilization later patient relieved of pain.

Pub med search showed 811 published reports of which were 580 suitable for review. The topics of the articles were 5 on radiation exposure, 136 on biomechanical issues, 480 Review articles, 40 retrospective studies, 90 prospective studies, and 177 non randomized studies are seen. The studies comparing Percutaneous Balloon Kyphoplasty v/s Vertebroplasty vs. Conservation treatment we have 18 Prospective and 3 non-randomized studies. 2752 vertebral bodies in 1573 patients were reported with average 90% success rate.

All these studies suggests no correlation was found between

- Volume of cement injected and pain relief, bipedicular versus unipedicular vertebroplasty with pain
- Degree of vertebral body correction and volume of cement
- Between viscosity and pain relief.

Literature suggesting the amount of cement used per vertebral body varies from 2 ml to 11 ml as per reported by Heini PF Et al [82-84].

In the risk of cement leakage into the epidural space and veins increases with higher volume of cement insertion, Ruy K et al [85] .Hence ,it is suggested that attempts to inject more than 5 ml per Vertebral Body should be avoided ,lee BJ et al.[85]

Neurological complications reported in the literature are variable. Paraplegia is reported in series of lee 2002 [85] in one case who later died of myocardial infarction during the decompression surgery. Paraparesis has been reported by following authors:

OVCF case report: improved after L2 decompression -Roth et al.

OVCF + Tumours retrospective study: Recovered after decompression 4.7% (1/21 pt)

Altered proprioception and vibration sense, Mousavi et al [88].OVCF retro failed to improve with decompression 7.6% (1/13 pt).

Pulmonary embolism is seen either due to fat embolism or embolism due to the cement leakage. Yoo 2004 case report cements ARDS OVCF which was treated by embolectomy in one case which was fatal. Another case reference is by Antonia et al [89] cement hypercapnea & loss of conscious.

Other complications are like transient increases in pain during vertebroplasty attributed to Increase in pressure in a painful vertebra, Inflammatory reaction to PMMA,Osseous ischemia

Infection:

One case report of osteomyelitis in patient who underwent PVP one week after a urinary tract infection. Infective agent reported was staphylococcus epidermidis infection 2.4% (1/41pts) treated with vertebroplasty for vertebral compression fractures by Kallmes D, et al.[90,91] .We have not encountered infection in any cases. Strength restoration seen after percutaneous vertebroplasty. Mathis et al in a study reported restoration to pre-damage values if PMMA was used equal to about = 15% vertebral body volume. If this value exceeds 30% then it substantially exceeded the intact value.

Other materials like tricalcium phosphate have shown similar increase in initial strength. Hydroxyl-intact value. Belcoff SM AJNR 200.There is mostly class III and possibly almost class II data that shows vertebral augmentation beneficial in terms of pain relief. There is class II (class III) data showing augmentation is superior to conservative treatment in terms of pain relief.

Our experience in multilevel osteoporotic fractures: We have done two level fractures in two cases and we inserted all the needle in the vertebrae simultaneously. Prepare the cement and start injecting simultaneously. One has to be very vigilant while injecting simultaneously. It is very essential to monitor cardiopulmonary status when more than one level is completed.

CONCLUSION

In our study, Vertebroplasty shows excellent results in immediate back pain reduction which is maintained further, improved quality of life and low rates of complications and revisions. So correct patient selection, proper positioning, understanding regional osseous, neural, vascular anatomy and the experience of the surgeon can improve the outcome of the procedure and minimize the complications. We suggest adhering following techniques may reduce the complication and improve the vertebroplasty results

- Proper inclusion criteria following complete preoperative evaluation
- Approach - Transpedicular
- Avoid breaking vertebral cortex or wall of the pedicle while inserting needle.
- Do not alter the ratio of the polymer and monomer of the cement while mixing the content.
- Ensure high viscosity of the cement
- Plan the strategy to treat the compression fracture with osteoporosis or with malignancy. As the vascularity will be increased in malignancies and fresh fractures. In highly vascular situations, start injecting cement when its consistency becomes toothpaste like after rat tailing.

- Use pusher to clear up the needle to avoid lolly pop sign and extravasations of cement into the canal if pedicle is breeched.

- Do osseous venogram and change the position of the needle tip away from the vascular channel or rotate the tip of the needle away, or change the path of the needle if the leak is persistent.

- Treat Osteoporosis and cause of the fracture to prevent further fractures.

Hence in future the surgeon will have a number of other safer options like Sky expander, vesselpasty depending upon the indication for the treatment of vertebral compression fractures by minimally invasive technique. We emphasis vertebroplasty in osteoporotic wedge compression fracture is one of the better treatment options available, which gives good functional outcome with regard to fast pain relief, patient satisfaction , early return to work.

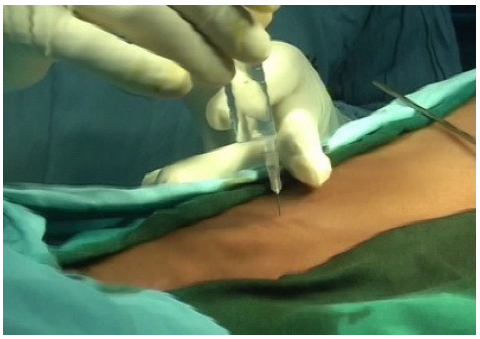
From our study, we conclude that the Vertebroplasty are promising innovations with the benefit of quick improvement in mobility, markedly decreases pain-related doctor visits, stature, and decreases use of NSAIDS post operatively in the management of osteoporotic wedge compression fracture.

MATERIALS REQUIRED

RADIOLUCENT TABLE

C- ARM

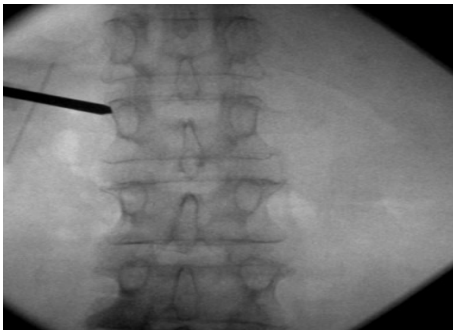
COOKS NEEDLE 11 G / 15 CM WITH VERTEBROPLASTY CEMENT

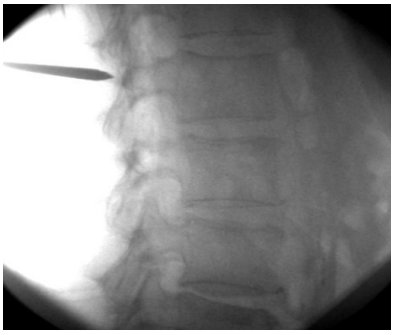


PRONE POSTION **INFILTRATION OF LOCAL**

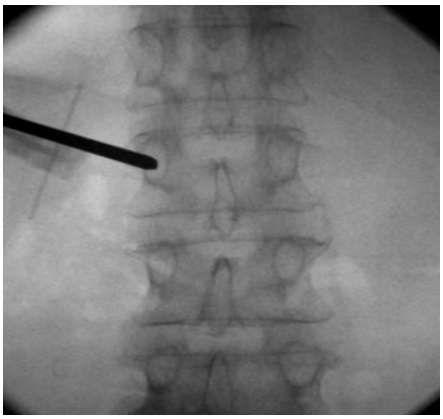
VERTEBROPLASTY TECHNIQUE

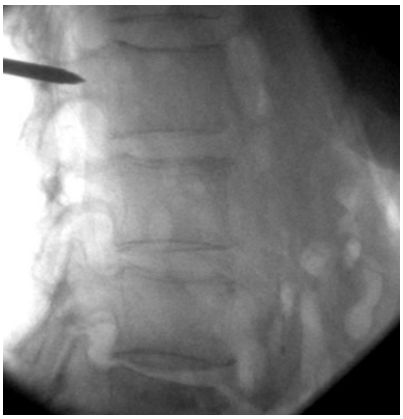
LEVEL MARKING UNDER C-ARM



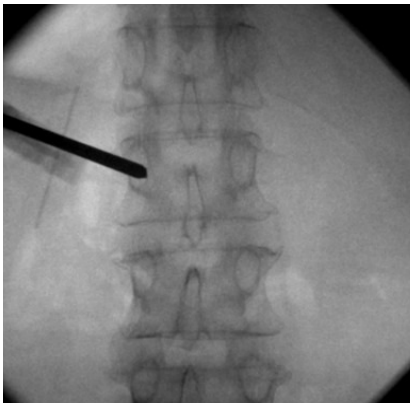


C ARM ANTEROPOSTERIOR AND LATERAL VIEW AT PEDICLE ENTRY





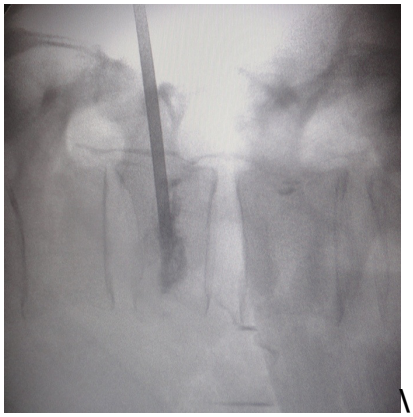
ANTEROPOSTERIOR VIEW AND LATERAL VIEW NEDDLE AT MIDPEDICULAR



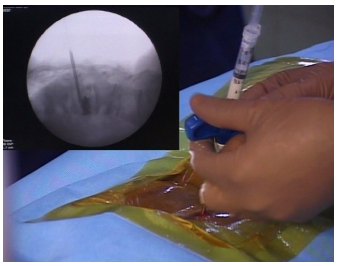
AP VIEW NEEDLE AT MEDIAL BORDER OF PEDICLE AND IN

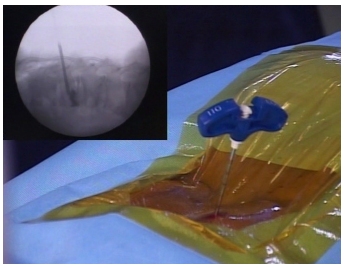
LATERAL VIEW NEEDLE AT POSTERIOR THIRD OF VERTEBRL BODY

MALLETING NEEDLE & DYE –UROGRAFFIN

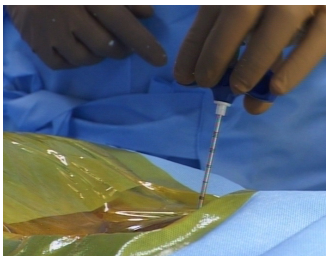


INTRAOSSEOUS VENOGRAM & RAT TAILING (IDEAL CONSISTENCY)

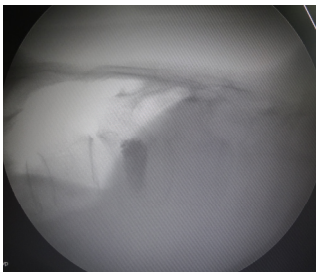


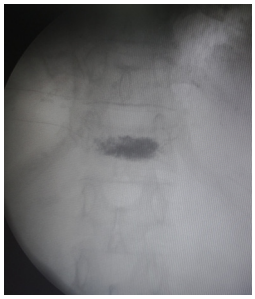


INJECTING CEMENT USING 3ML SYRINGE UNDER C ARM LATERAL VIEW



KEEP TURNING NEEDLE

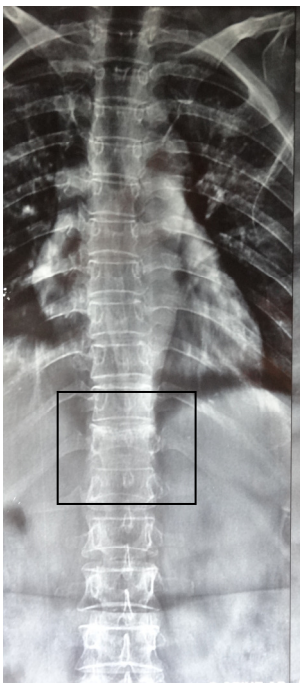




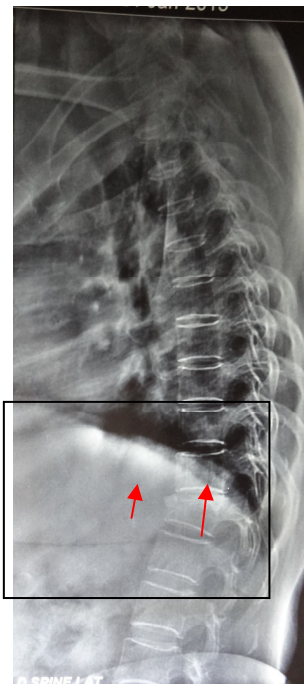
C ARM ANTEROPOSTERIOR AND LATERAL VIEW AFTER VERTEBROPLASTY

IMMEDIATE POST OPERATIVE ANTEROPOSTERIOR AND LATERAL VIEW OF VERTEBROPLASTY

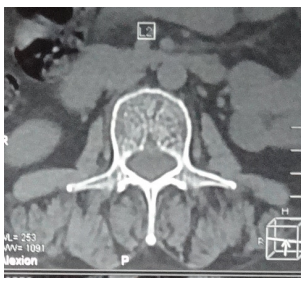
CASE - 1

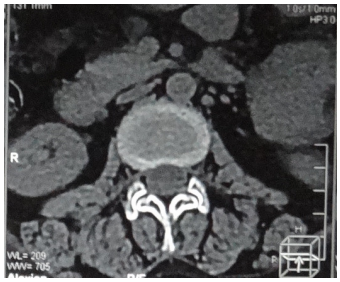


D11 WEDGE COMPRESSION



ANTEROPOSTERIOR AND LATERAL VIEW OF DORSOLUMBAR SPINE



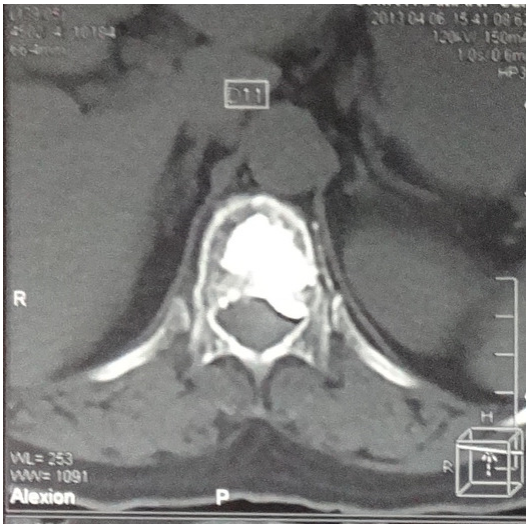


PREOPERATIVE CT SCAN – SAGITTAL AND AXIAL VIEW TO RULE OUT PEDICLE FRACTURE AND RETROPULSION OF FRAGMENTS

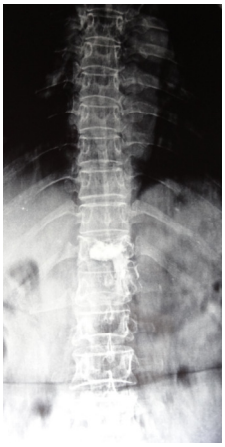
D11

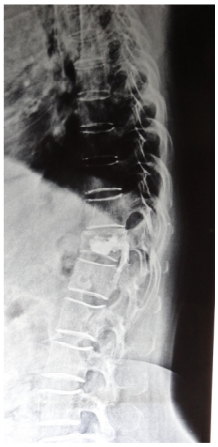
VERTEBROPLASTY

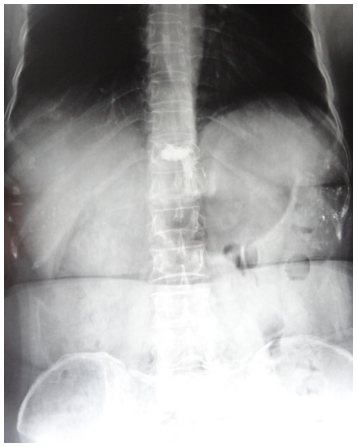
IMMEDIATE POST OPERATIVE ANTEROPOSTERIOR AND LATERAL VIEW



IMMEDIATE POST OPERATIVE CT –SAGITTAL AND AXIAL SECTION SHOWING NO CEMENT LEAKAGE

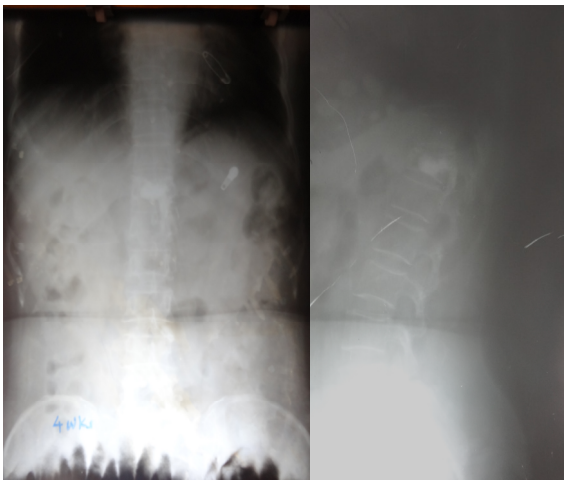






ONE MONTH FOLLOW UP

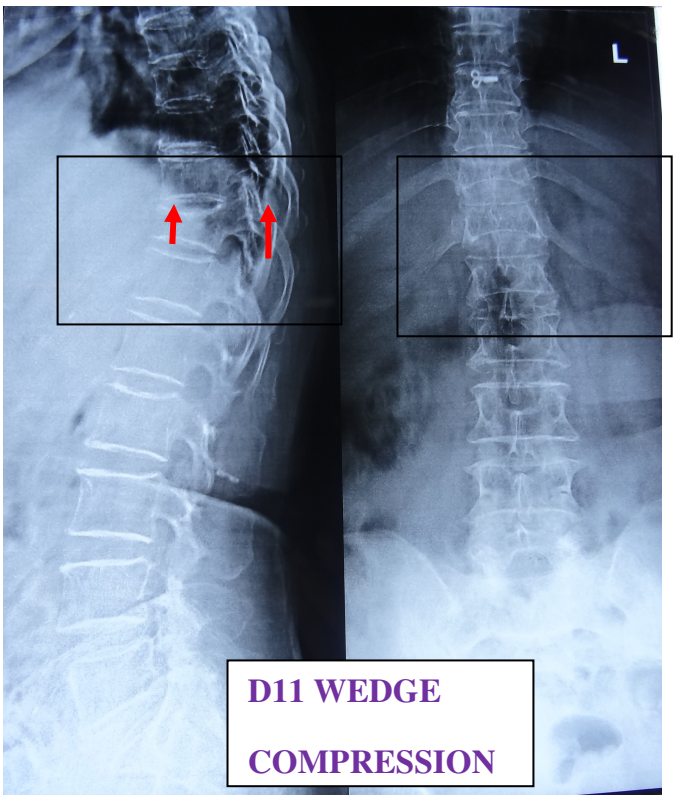
THREE MONTH FOLLOW UP

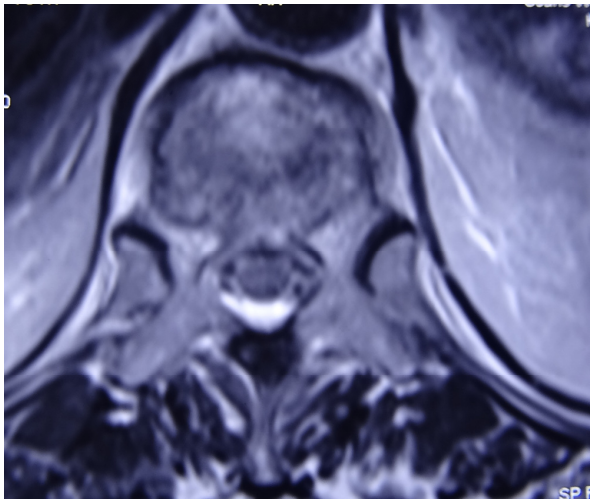


SIX MONTH FOLLOW UP **ONE YEAR FOLLOW UP**

FUNCTIONAL OUTCOME

CASE 2

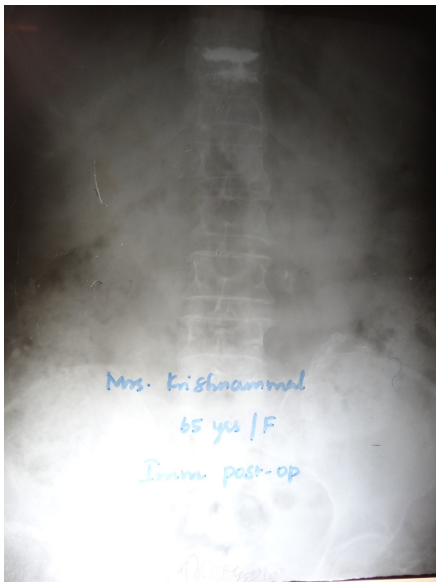

L
D11 WEDGE
COMPRESSION

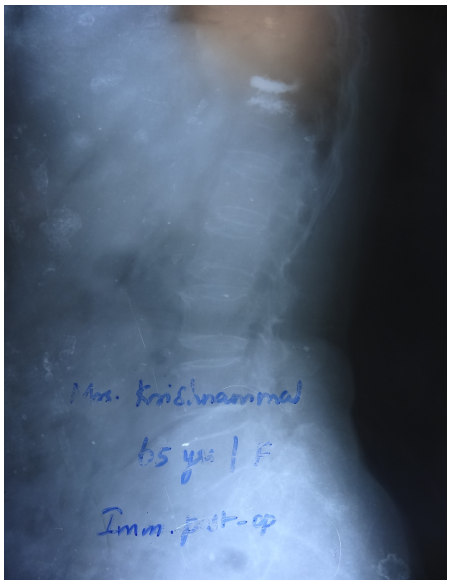


PREOPERATIVE MRI SCAN – SAGITTAL AND AXIAL VIEW TO RULE OUT PEDICLE FRACTURE AND EXTENSION OF FRAGMENTS

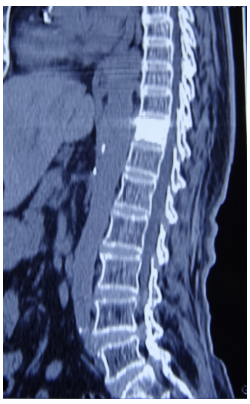
D11

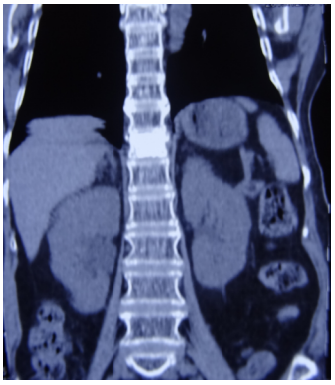
VERTEBROPLASTY

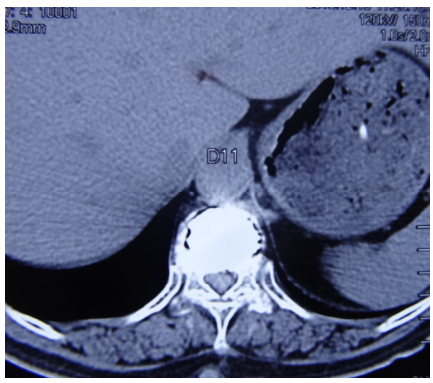




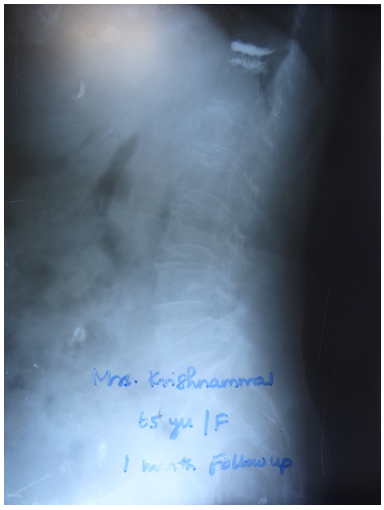
IMMEDIATE POST OPERATIVE ANTEROPOSTERIOR AND LATERAL VIEW



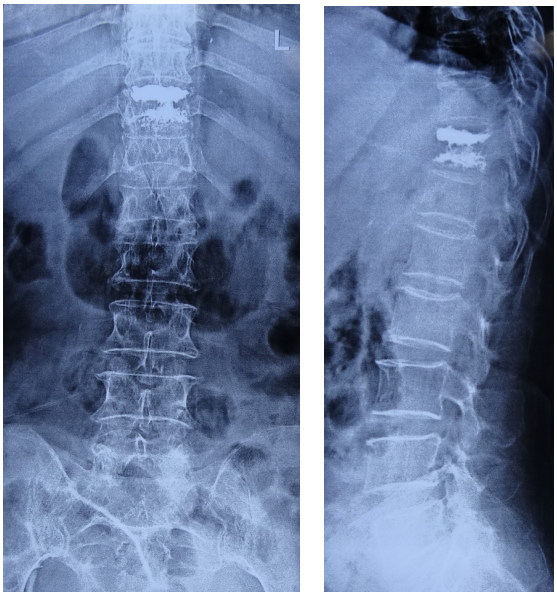




IMMEDIATE POST OPERATIVE CT –SAGITTAL AND AXIAL SECTION SHOWING NO CEMENT LEAKAGE



ONE MONTH & 3 MONTH FOLLOW UP

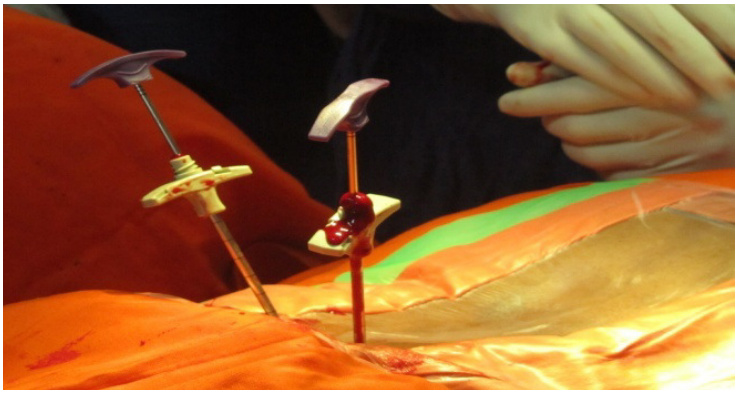


SIX MONTH FOLLOW UP

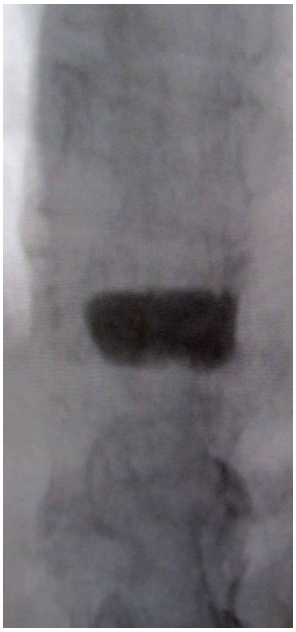
ONE YEAR FOLLOW UP

FUNCTIONAL OUTCOME

BIPEDICULAR VERTEBROPLASTY

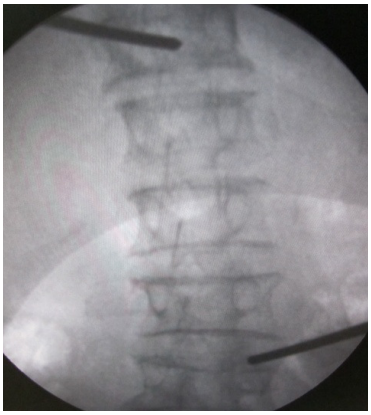


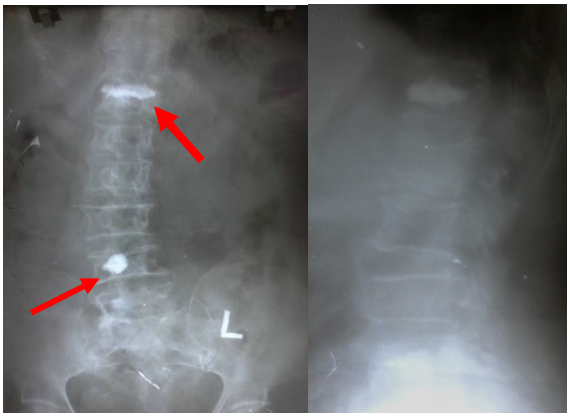
WEDGE COMPRESSION FRACTURE & INTRA OPERATIVE BIPEDICULAR APPROACH



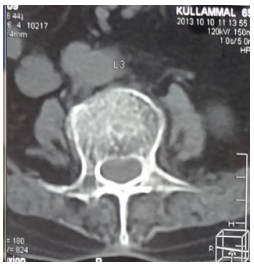
IMMEDIATE POST OPERATIVE X RRAY ANTERO POSTERIOR AND LATERAL VIEW

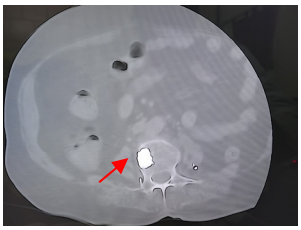
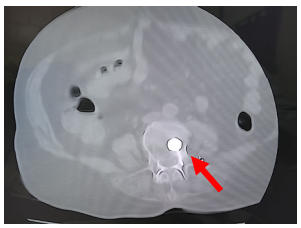
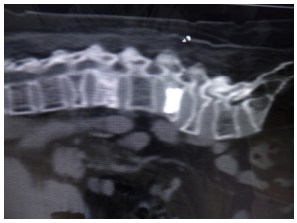
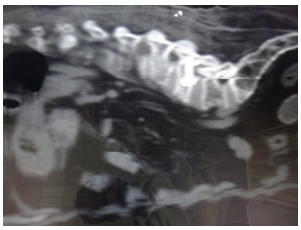
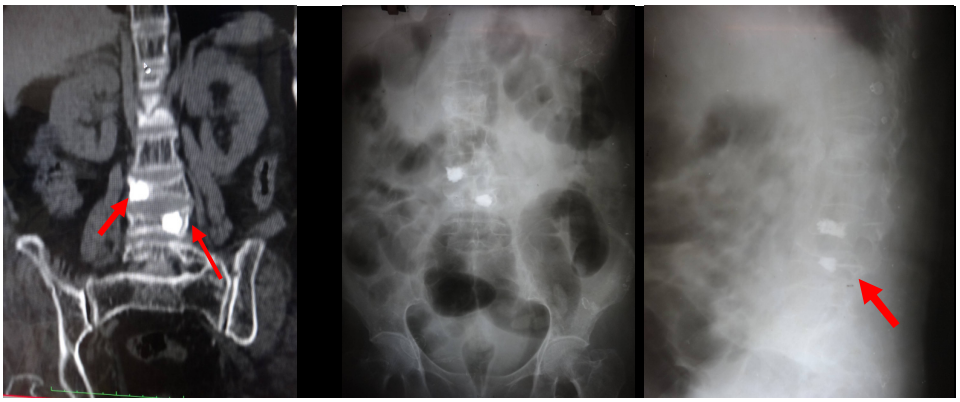
TWO LEVEL VERTEBROPLASTY- D12, L4



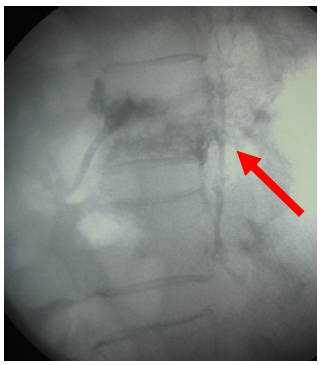
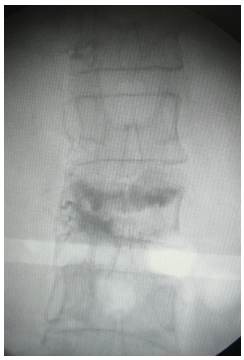
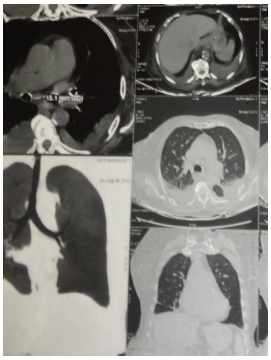


ADJACENT LEVEL VERTEBROPLASTY –L3, L4

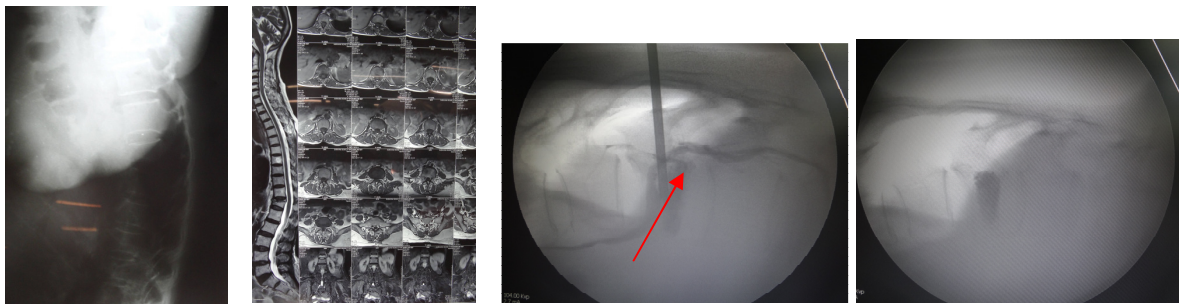


CEMENT LEAKAGE INTO VENOUS CHANNELS

D12 FRACTURE WITH CEMENT LEAKAGE INTO VENOUS CHANNELS AND POST OPERATIVE CT CHEST TO RULE CEMENT EMBOLISM

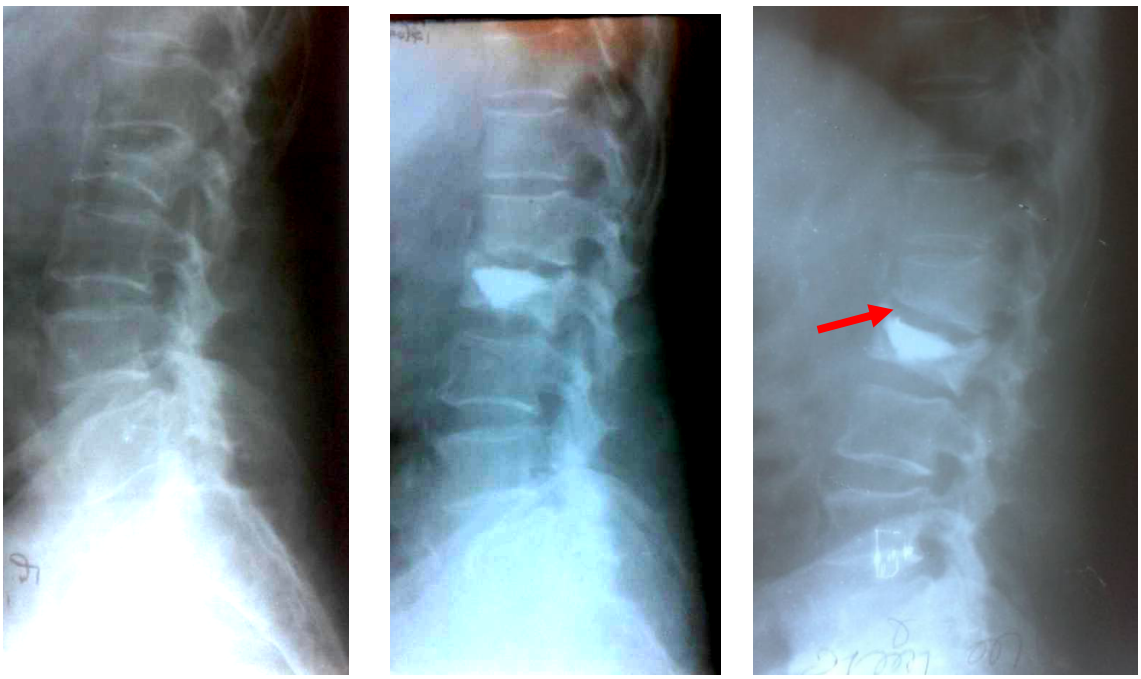


INTRAOSSEOUS VENOGRAM SHOWING DYE LEAKAGE & INTRA OPERATIVE

C-ARM FOLLOWING VERTEBROPLASTY SHOWS NO CEMENT LEAKGE

ADJACENT LEVEL FRACTURE

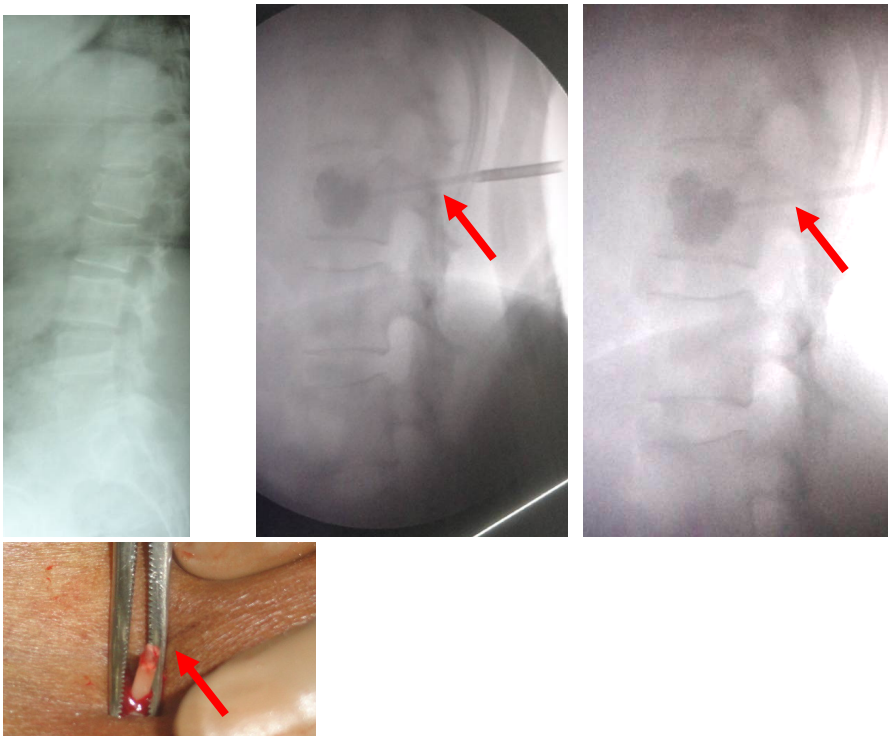
L2 WEGE COMPRESSION FRACTURE – SHOWING ADJACENT LEVEL FRACTURE AT 6 MONTH FOLLOW UP



ONE MONTH FOLLOW UP NO ADJACENT LEVEL FRACTURE

SIX MONTH FOLLOW UP SHOWING ADJACENT LEVEL FRACTURE

"LOLLY POP SIGN"



INTRAOPERATIVE C ARM LATERAL VIEW AND CLINICAL PHOTO SHOWING LOLLY POP SIGN

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PROFORMA FOR VERTEBROPLASTY

Name :

Age / Sex :

IP number :

Address :

Contact Number :

Date of Admission :

Date of Surgery :

Date of Discharge :

Occupation :

Education :

Socioeconomic Status :

Diagnosis :

Procedure Done :

Outcome :

HISTORY:

1. Mode of injury : Road traffic accident / Fall at home / Fall from height /other
2. Presenting complaints :

a. Pain – site / duration

b. Swelling – site / extent

c. Deformity

d. H/o Neurogenic Clauducation

e. LOC/ENT bleed / Vomiting

f. Co morbid illnesses :

Diabetes mellitus		Hypertension		Coronary heart disease	
Renal disorder		Seizures /Neurological disorder		Hepatic disorder	
Dyslipedemia		Endocrine disorder		Tuberculosis	
Bronchial Asthma		Chronic Obstructive lung diseases		Neoplastic disorders	

d. Drug history : Steroids / Disease modifying anti-rheumatoid drugs / Immunosuppresants

PAST HISTORY:

- Any similar injuries
- Previous surgeries or hospitalisations
- Any major illnesses

PERSONAL HISTORY:

Diet	Vegetarian / Mixed
Marital Status	Married / Single
Bowel and Bladder habits	Regular / Altered

Habits	Smoking / Alcohol / Tobacco / Drug Addictions / Others

OBSTETRIC & GYNAECOLOGY HISTORY:

TREATMENT HISTORY:

FAMILY HISTORY:

CLINICAL EXAMINATION:

GENERAL EXAMINATION:

- ☞ Appearance :
- ☞ Built :
- ☞ Pallor :
- ☞ Icterus :
- ☞ Cyanosis :
- ☞ Clubbing :
- ☞ Pedal Edema :
- ☞ Lymphadenopathy :

VITALS:

1. Pulse :
2. BP :
3. Respiratory rate :
4. Temperature :

SYSTEMICEXAMINATION :

- ☞ Cardiovascular system :
- ☞ Respiratory system :
- ☞ Abdomen :

OTHER INJURIES

- Preop planning :

Local Tenderness

Neurological Examination

A) Motor

B) Sensory

C) Radiculopathies

D) Bowel & Bladder :

E) Gait:

F) Pain score – Visual analogue scale ,

G) Oswestry Low Back Pain Disability Questionnaire & Quebac back pain disability scale

Investigation:

Hb%		TC		DC	P L B E M
ESR		BT/CT		RBS	
UREA		S.CREATININE		ELECTROLYTES	Na^+ K^+
HBsAg		HIV		VDRL	
CXR		ECG		URINE ROUTINE ALBUMIN SUGAR DEPOSITS Bence Jones Protein	
Blood G & T					
Calcium		Alkaline Phosphatase ALP*		Serum Electrophorosis*	

X-ray –AP

Lateral view (Standing / Flexion)

Oblique

CT scan-

A) Foraminal compression

B) Posterior wall integrity

C) Retropulsion of Fracture fragment

D) Vacuum Phenomenon

E) CT With Myelogram if MRI Contraindicated

F) 3d CT *

MRI scan-

A) Intra Osseous Bone Marrow Edema

B) Vacuum Phenomenon

- **Operative and Post operative details**

Position :

Procedure :

Anaesthesia :

Approach (Transpedicular Approach) :

Bipedicular / Unipedicular :

Two Levels :

Needle(Gauge & Length) :

Dye(Intra Osseous Venography) :

Dye spillage :

Wake up test :

Volume of cement injected :

Cement viscosity :

- Intraoperative Complication :

Hypotension ☐ Cement Embolism ☐ Lolly pop Sign ☐

Para – vertebral cement leakage :

- Post-op complications :

  Pain :

  Adjacent Vertebral fracture

  Nerve palsy :

  Vascular injury :

  Cement-embolism :

  Local Haematoma formation :

  Urinary tract infection :

  Infection :

- Pt Instructed to call for New back Pain, Chest Pain, Lower Extremity Weakness & loss of sensation , Fever

  Post op pain relief :

PROCEDURE NOTES:

POST OP PERIOD:

Post OP CT findings *:

FOLLOW UP (After discharge)	PAIN RELIEF	X–RAY FINDINGS	ADVICE
FIRST WEEK			
SECOND WEEK			
FIRST MONTH			
SECOND MONTH			
THIRD MONTH			
SIXTH MONTH			
NINTH MONTH			

ONE YEAR			
Two year			

OUTCOME: All the parameters are graded to facilitate Functional analysis

Pre operative

1. Age
1. 50 – 60
2. > 60
2. Sex
1. Male
2. Female
3. Duration

Months

1. 0 – 6
2. 6 – 12
3. 12 – 18
4. > 3

4. Job
   1. Sedentary
   2. Manual (mod)

3. Heavy (sev)

Symptoms pattern

Back pain

Visual analog scale

1 2 3 4 5 6 7 8 9 10

Radicular pain

Visual analog scale

1 2 3 4 5 6 7 8 9 10

Oswestry disability questionnaire for ODS /ODI

1. Pain Intensity 0 1 2 3 4 5
2. Personal Care 0 1 2 3 4 5
3. Lifting 0 1 2 3 4 5
4. Walking 0 1 2 3 4 5
5. Sitting 0 1 2 3 4 5
6. Standing 0 1 2 3 4 5
7. Sleeping 0 1 2 3 4 5
8. Social Life 0 1 2 3 4 5
9. Travelling 0 1 2 3 4 5
10. Sex life (if applicable)0 1 2 3 4 5

Radiology
X-Ray
1. Normal
2. Progression Of kyphosis
3. Adjacent Fracture
4. Cement leakage
5. Cement embolism
6. Extravasation of cement
7. Loly pop sign

Level
D 10,D11,D12, L1 ,L2 ,L3,L4 , L5
Post operative
Immediate Post op – Xray

CT scan –

Oswestry disability questionnaire
1. Pain Intensity 0 1 2 3 4 5 6
2. Personal Care 0 1 2 3 4 5 6
3. Lifting 0 1 2 3 4 5 6
4. Walking 0 1 2 3 4 5 6
5. Sitting 0 1 2 3 4 5 6
6. Standing 0 1 2 3 4 5 6
7. Sleeping 0 1 2 3 4 5 6
8. Social Life 0 1 2 3 4 5 6
9. Traveling 0 1 2 3 4 5 6

10. Sex life (if applicable)0 1 2 3 4 5 6

X-Ray

Post operative followed in 1, 3 and 6 months intervals

Analysis

- Oswestry disability questionnaire

1. Pain Intensity 0 1 2 3 4 5 6
2. Personal Care 0 1 2 3 4 5 6
3. Lifting 0 1 2 3 4 5 6
4. Walking 0 1 2 3 4 5 6
5. Sitting 0 1 2 3 4 5 6
6. Standing 0 1 2 3 4 5 6
7. Sleeping 0 1 2 3 4 5 6
8. Social Life 0 1 2 3 4 5 6
9. Travelling 0 1 2 3 4 5 6
10. Sex life (if applicable)0 1 2 3 4 5 6

- Severity of pain

0 1 2 3 4 5 6 7 8 9 10

Any Signs and Symptoms

X-Ray – AP, Lateral,

NEUROLOGICAL CHART

NAME :

AGE/ SEX :

IP NO :

DATE OF ADMISSION :

HIGHER MENTAL FUNCTIONS ASSESMENT - NORMAL / ABNORMAL

CRANIAL NERVES - NORMAL / ABNORMAL

MOTOR SYSTEM

MOTOR	RIGHT	LEFT
BULK – MID ARM FORE ARM THIGH LEG CIRCUMFERENCE		
TONE –		

FINGERS WRIST ELBOW SHOULDER TOES ANKLE KNEE HIP		
POWER UL - SHOULDER – Abd & Add Flex & Ext ELBOW - Flex &Ext WRIST - Ext & Flex Hand Grip LL – HIP - Add & Abd Flex & Ext KNEE - Ext & Flex ANKLE - Dorsiflex Plantar flex		

Inversion Eversion		
I INVOLUNTARY MOVEMENT		

REFLEXES	RIGHT	LEFT
SUPERFICIAL REFLEXES ABDOMINAL (T7 – T 12) CREMASTRIC (L1 , L2) BULBOCAVERNOUS (S2 , S3 , S4) ANAL (S2 , S3 ,S4) PLANTAR REFLEX (S1)		

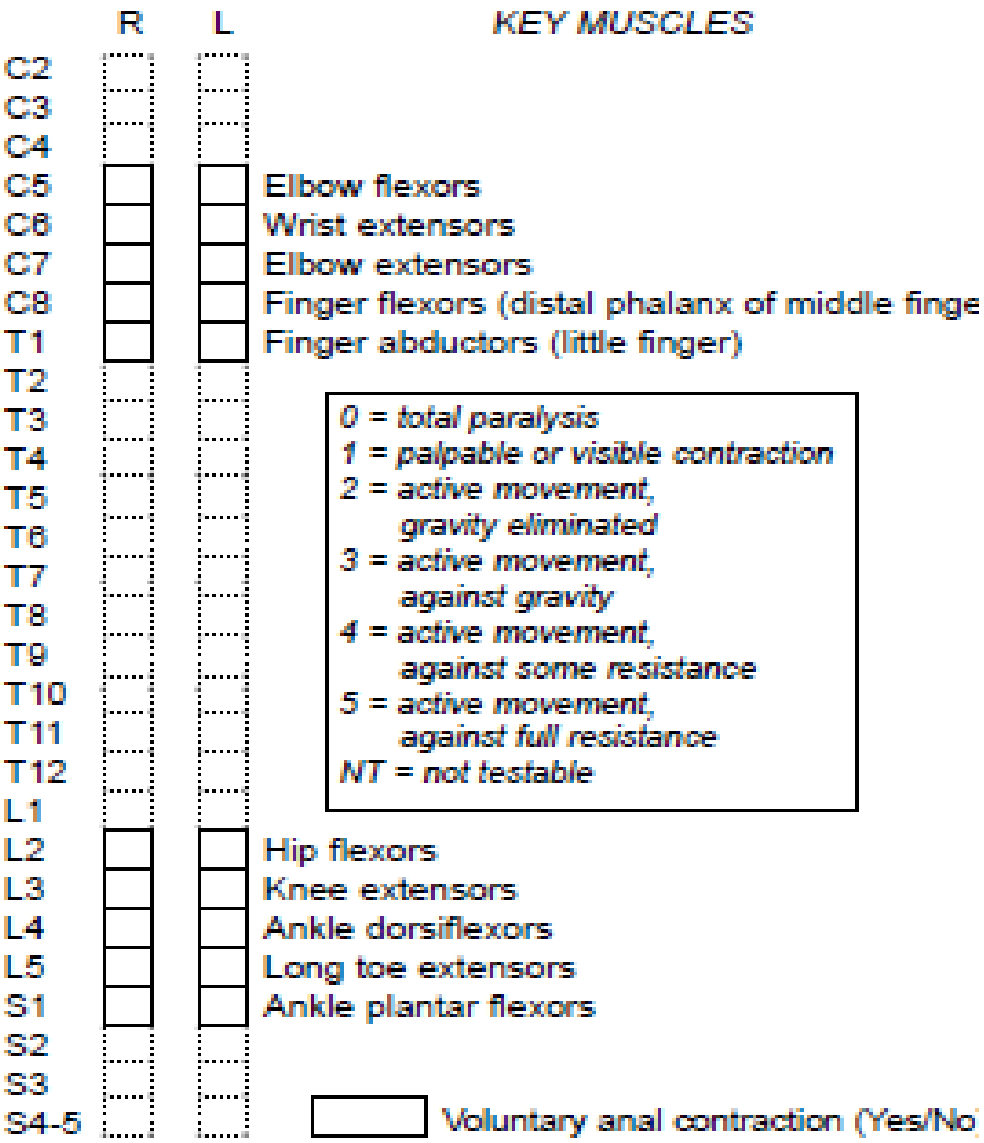
DEEP REFLEXES BICEPS (C5 , C6) TRICEPS (C6 , C7) SUPINATOR (C5 , C6) KNEE (L2 , L3 , L4) ANKLE (S1 , S2) CLONUS – PATELLAR & ANKLE		

SENSORY SYSTEM	RIGHT	LEFT
SUPERFICIAL - TOUCH - PAIN - TEMPERATURE		
DEEP - PRESSURE - VIBRATION - JOINT POSITION		

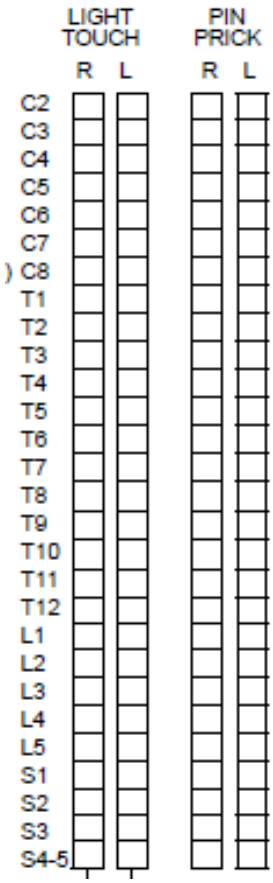
- GAIT

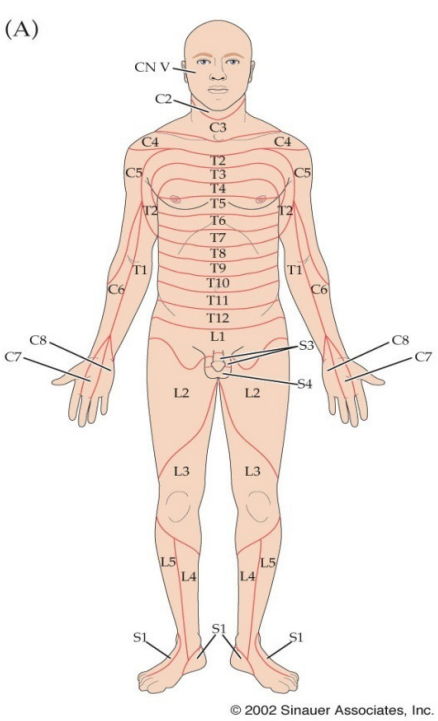
- AUTONOMIC NERVOUS SYSTEM - SWEATING
  BOWEL CONTROL BLADDER CONTROL

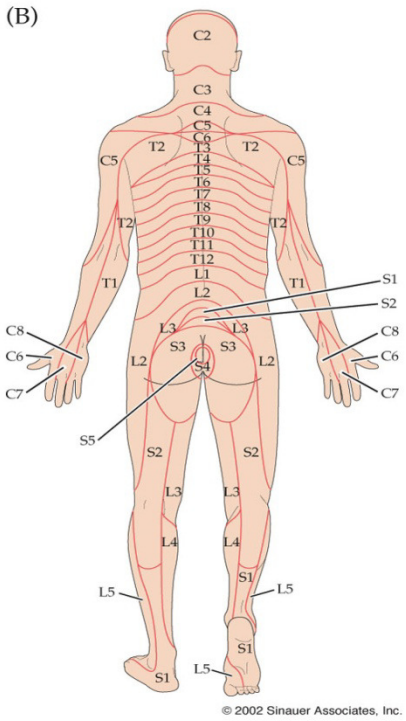
PNS EXAMINATION - MYOTOME



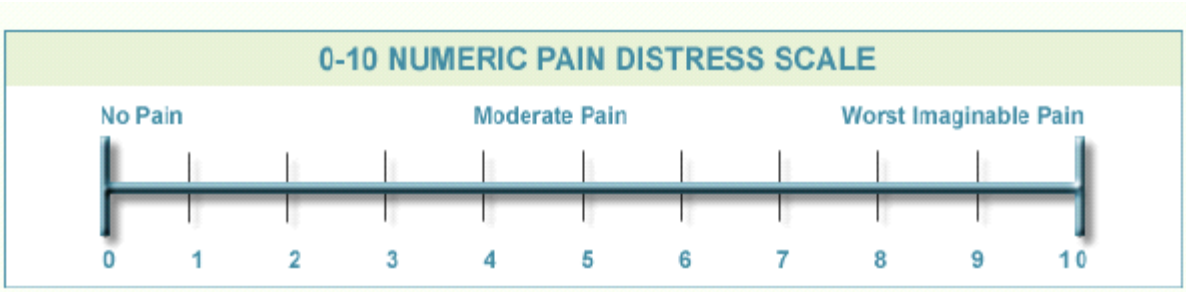
SENSORY EXAMINATION - DERMATOME







Visual analog pain scale -10 point scale




SYNVISC ONE
PAIN SCALE
0 1 2 3 4 5 6 7 8 9 10
SANOFI BIOSURGERY

S NO	NAME	AGE	SEX	DOI	DOA	DOS	DOD
1	MRS.DIVYA	60YRS	F	8.5.12	10.6.12	18.6.12	28.6.12
2	MR.SIVAPATHAM	78YRS	M	7.5.12	13.7.12	17.7.12	30.7.12
3	MRS.GOMATHI	61YRS	F	20.6.12	14.8.12	17.8.12	23.8.12
4	MRS.LAKSHMI	63YRS	F	19.5.12	18.8.12	20.8.12	25.8.12
5	MR.SUBRAMANI	65YRS	M	8.7.12	18.8.12	20.8.12	25.8.12
6	MR.KUMARASAMY	80YRS	M	11.7.12	20.8.12	23.8.12	28.8.12
7	MRS.KASTHURI BAI	60YRS	F	1.6.12	22.8.12	28.8.12	1.9.12
8	MR.ANAMALAI	65YRS	M	3.8.12	10.9.12	19.9.12	21.9.12
9	MR.ARUL	68YRS	M	5.9.12	9.10.12	15.10.12	18.10.12
10	MRS.CHINTHAMANI	62YRS	F	6.10.12	4.11.12	16.11.12	18.11.12
11	MRS.KRISHNAMMAL	65YRS	F	21.10.12	2.12.12	8.12.12	12.12.12
12	MRS.KULLAMMAL	60YRS	F	10.11.12	12.12.12	30.12.12	7.1.13
13	MRS.PHILOMINA	60 YRS	F	13.11.12	24.12.12	8.1.13	12.1.13
14	MRS.ADHILAKSHMI	55YRS	F	2.12.12	2.1.13	12.1.13	18.1.13
15	MRS.KAMALAM	58YRS	F	3.12.13	15.1.13	22.1.13	30.1.13
16	MR.SURESH	68YRS	M	3.1.13	9.2.13	12.2.13	19.2.13
17	MRS.RATHNA	65YRS	F	14.1.13	18.2.13	23.2.13	30.2.13
18	MR.KALAIMANI	65YRS	M	12.1.13	26.2.13	1.3.13	5.3.13
19	MRS.UMA	60YRS	F	4.2.13	13.3.13	20.3.13	25.3.13
20	MRS.MOHANA	65YRS	F	2.3.13	2.4.13	10.4.13	13.4.13
21	MR.VENKATESH	67YRS	M	13.3.13	12.4.13	19.4.13	25.4.13

22	MR.SALIM	65YRS	M	1.3.13	14.4.13	19.4.13	25.4.13
23	MRS.MAHALAKSHMI	60YRS	F	21.3.13	30.4.13	2.5.13	6.5.13
24	MRS.EKIMA	59YRS	F	10.4.13	14.5.13	20.5.13	28.5.13
25	MR.ANDAL	55YRS	F	3.4.13	27.5.13	1.6.13	5.6.13
26	MRS.RADHIKA	60YRS	F	6.5.13	24.6.13	29.6.13	3.7.13
27	MR.SHANKAR	65YRS	M	20.5.13	3.7.13	6.7.13	8.7.13
28	MRS.GOVINDH RAJ	67YRS	M	5.6.13	14.7.13	18.7.13	23.7.13
29	MR.ANAND	68YRS	M	15.6.13	20.7.13	28.7.13	30.7.13
30	MRS.BAKIYAM	65YRS	F	4.6.13	1.8.13	8.8.13	13.8.13
31	MRS.PRAVEEN	65YRS	M	1.7.13	7.8.13	11.8.12	17.8.13
32	MRS.SAPNA	60YRS	F	20.7.13	7.9.13	12.9.13	17.9.13
33	MRS.PANDIAMMAL	62YRS	F	29.7.13	8.9.13	15.9.13	21.9.13
34	MRS.SAVITHRI	72YRS	F	11.5.13	17.9.13	20.9.13	24.9.13
35	MRS.VIMALA	70YRS	F	1.8.13	24.9.13	30.9.13	2.10.13

S NO	DURATION	OCCU	AO	DENNIS	GENANTS	MOI	CO MORBD	ST
1	50	S	53A1	TYPE B	WG GR 1	SF	-	D12,L1
2	70	S	53A1	TYPE B	WG GR 1	SF	CAD	L4,L5

3	57	M	53A1	TYPE B	WG GR 2	SF	-	L2,L3
4	91	S	53A2	TYPE D	BI GR 2	SF	-	L2
5	42	M	53A2	TYPE D	BI GR 3	SF	-	D12,L1
6	41	M	52A1	TYPE B	WG GR 1	SF	CLD	D12
7	87	S	52A1	TYPE B	BI GR 3	SF	-	D12
8	46	M	53A2	TYPE D	BI GR 2	SF	PARK	L1,L2
9	40	S	52A2	TYPE D	BI GR 1	RTA	DM	D12
10	40	S	52A2	TYPE D	WG GR 1	RTA	-	D11
11	47	S	53A1	TYPE B	WG GR 1	FH	-	D11
12	50	S	53A2	TYPE D	BI GR 2	SF	DM	L3,L4
13	57	S	53A1	TYPE B	WG GR 1	RTA	-	L1,L2
14	40	M	53A1	TYPE B	WG GR 1	FH	-	D12
15	49	M	52A1	TYPE B	WG GR 1	RTA	-	D12,L1
16	39	M	53A2	TYPED	BI GR 2	FH	-	L3,L4
17	41	S	53A2	TYPE D	BI GR 1	SF	DM	L1,L2
18	47	M	53A1	TYPE B	WG GR2	RTA	-	L2
19	44	M	53A2	TYPE D	BI GR 2	FH	-	L1
20	38	S	53A1	TYPE B	WG GR 1	SF	DM	L1,L2,L3,L4
21	36	M	52A1	TYPE B	BI GR1	RTA	-	D12
22	48	M	52 A2	TYPE D	BI GR2	SF	-	D12
23	46	S	53A1	TYPE C	WG GR 2	FH	-	L1
24	40	M	53A2	TYPE B	WG GR 1	RTA	-	L2
25	58	M	52A1	TYPE B	WG GR 1	RTA	-	D12

26	53	S	52A1	TYPE B	WG GR 2	SF	-	D12
27	50	S	53A1	TYPE B	WG GR 1	FH	DM	L1
28	43	M	53A2	TYPE D	BI GR 2	SF	-	L2,L3
29	43	S	52A1	TYPE B	WG GR 2	FH	-	D12
30	64	S	53A2	TYPE D	BI GR 2	SF	DM	L1,L2
31	40	S	53A1	TYPE B	WG GR 1	FH	DM	L4
32	52	M	53A1	TYPE B	WG GR 1	RTA	-	L1
33	45	S	52A1	TYPE B	WG GR1	SF	DM	L3,L4
34	129	S	52A2	TYPE D	BI GR 2	SF	-	D12
35	58	S	52A1	TYPE C	WG GR 2	RTA	DM	D12

S NO	NEU	BLI/BOI	FRANKEL	OTHER INJURY	LEVEL	AC	MC	PC
1	-	-	E	-	L1	+	-	-
2	-	-	E	-	L5	+	+	-
3	-	-	E	-	L2	+	-	-
4	-	-	E	-	L2	-	+	-
5	-	-	E	-	L1	+	+	-
6	-	-	E	-	D12	+	-	-
7	-	-	E	-	D12	+	-	-

8	-	-	E	IT	L2	-	+	-
9	-	-	E	-	D12	+	+	-
10	-	-	E	-	D11	+	-	-
11	-	-	E	-	D11	+	-	-
12	-	-	E	-	L3,L4	+	+	-
13	-	-	E	-	L1,L2	+	-	-
14	-	-	E	-	D12	+	+	-
15	-	-	E	-	D12	+	-	-
16	-	-	E	-	L3	+	+	-
17	-	-	E	-	L1	+	-	-
18	-	-	E	-	L2	+	+	-
19	-	-	E	-	L1	+	-	-
20	-	-	E	DR	L1,L2,L3	+	+	-
21	-	-	E	-	D12	+	+	-
22	-	-	E	-	D12	+	-	-
23	-	-	E	-	L1	+	-	-
24	-	-	E	-	L2	+	+	-
25	-	-	E	-	D12	+	+	-
26	-	-	E	-	D12	+	-	-
27	-	-	E	-	L1	+	+	-
28	-	-	E	-	L1	+	-	-
29	-	-	E	DR	D12	+	+	-
30	-	-	E	-	L2	+	-	-

31	-	-	E	-	L4	+	-	-
32	-	-	E	-	L1	+	-	-
33	-	-	E	-	L3,L4	+	-	-
34	-	-	E	CAL	D12	+	+	-
35	-	-	E	-	D12	+	-	-

S NO	CA	AVH - PREOP	PVH - PREOP	BECKS INDEX	MRI/CT	PRE-OP VAS	PREOP ODS	PREOP ODI	DOS
1	<5	28	31	0.9	-	7	23	51	45
2	8	24	30	0.8	L5/RP-	9	32	71	45
3	<5	25	27	0.9	-	9	28	62	50
4	<5	28	30	0.9	L2OLD	7	27	60	40
5	8	24	30	0.8	-	9	28	62	45
6	<5	30	34	0.8	D12 NEW	8	26	57	55
7	<5	28	32	0.8	RP-	9	30	66	40
8	7	24	28	0.8	-	8	26	57	35
9	6	24	26	0.9	D12 NEW	9	29	64	55
10	<5	25	28	0.8	RP-	8	22	48	40
11	<5	24	30	0.8	D11 NEW	9	30	66	70

12	8	20,24	26,26	0.8	L3,L4 NEW	9	30	66	60
13	<5	20,24	25,26	0.75	L1NEW/L2OLD	9	28	62	40
14	10	20	24	0.8	NEW	9	34	75	45
15	6	23	25	0.9	NEW	9	30	66	40
16	8	23	23	0.9	NEW	8	28	62	40
17	8	20	24	0.8	NEW /RP-	9	26	57	45
18	<5	24	28	0.9	NEW/RP-	8	27	60	45
19	<5	24	26	0.9	NEW	8	28	62	45
20	15	18	22	0.8	L3NEW/L1,L2 OLD	8	28	62	40
21	8	24	27	0.8	NEW/RP-	8	26	57	45
22	<5	30	34	0.8	RP-	9	29	64	45
23	8	24	30	0.8	-	8	27	60	50
24	<5	25	27	0.9	RP-	7	26	57	55
25	10	20	26	0.8	NEW	9	27	60	45
26	<5	26	31	0.7	RP-	9	30	66	55
27	<5	27	34	0.75	RP-	9	27	60	45
28	<5	25	28	0.9	-	9	28	62	50
29	6	24	28	0.8	D12 NEW	9	28	62	55
30	10	20	22	0.9	NEW /RP-	9	27	60	45
31	<5	24	26	0.8	NEW	9	30	66	40
32	<5	24	26	0.8	NEW	9	28	62	45
33	15	21	23	0.9	L1,L2 (NEW)	9	32	71	60
34	6	23	26	0.8	D12 OLD -VP+	9	30	66	40

35	7	24	26	0.9	D12 NEW	9	29	64	45

S NO	ANAES	NEEDLE	CEMENT	DYE	CEMENT SETTIN TIME	DYE LEAKAGE	CEEMENT LEAKAGE	VOLUME OF CEMENT	PEDICLE
1	IV/LA	JN11G/15CM	DVTP	+	18	-	-	3	UNI
2	IV/LA	JN11G/15CM	DVTP	+	15	+	-	3	UNI
3	IV/LA	JN11G/15CM	DVTP	+	18	-	+	3.5	UNI
4	IV/LA	JN11G/15CM	DVTP	+	17	-	-	2.5	UNI
5	IV/LA	JN11G/15CM	DVTP	+	18	-	-	3	UNI
6	IV/LA	JN11G/15CM	DVTP	+	15	+	-	2.5	UNI
7	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
8	IV/LA	JN11G/15CM	DVTP		15	-	-	3	UNI
9	IV/LA	JN11G/15CM	DVTP	+	16	-	-	3	UNI
10	IV/LA	JN11G/15CM	DVTP	+	14	-	-	2.5	UNI
11	IV/LA	JN11G/15CM	DVTP	+	16	-	-	3	UNI
12	IV/LA	JN11G/15CM	DVTP	+	16	-	-	4	UNI
13	IV/LA	JN11G/15CM	DVTP	+	15	+	-	3	BI
14	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
15	IV/LA	JN11G/15CM	DVTP	+	16	-	+	3.5	UNI
16	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
17	IV/LA	JN11G/15CM	DVTP	+	12	-	-	2.5	UNI

18	IV/LA	JN11G/15CM	DVTP	+	14	-	-	2.5	UNI
19	IV/LA	JN11G/15CM	DVTP	+	16	+	-	2.5	UNI
20	IV/LA	JN11G/15CM	DVTP	+	16	-	-	2.5	UNI
21	IV/LA	JN11G/15CM	DVTP	+	16	-	-	2	UNI
22	IV/LA	JN11G/15CM	DVTP	+	17	-	-	2	UNI
23	IV/LA	JN11G/15CM	DVTP	+	14	-	-	2	UNI
24	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
25	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2	UNI
26	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
27	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
28	IV/LA	JN11G/15CM	DVTP	+	18	-	+	3.5	UNI
29	IV/LA	JN11G/15CM	DVTP	+	16	-	-	3	UNI
30	IV/LA	JN11G/15CM	DVTP	+	12	+	-	2.5	UNI
31	IV/LA	JN11G/15CM	DVTP	+	15	-	-	2.5	UNI
32	IV/LA	JN11G/15CM	DVTP	+	16	-	-	2	UNI
33	IV/LA	JN11G/15CM	DVTP	+	16	-	-	3.5	UNI
34	IV/LA	JN11G/15CM	DVTP	+	17	-	-	3.5	BI
35	IV/LA	JN11G/15CM	DVTP	+	13	-	-	2.5	UNI

S NO	NO OF LEVEL	COMP	VAS IMM	ODS IMM	ODI IMM	BECKS INDEX	AVH POST	CA POST

						POSTOP	OP	OP
1	1	-	4	17	38	0.9	30	<5
2	1	DL	5	25	55	0.8	25	<5
3	1	CL	3	22	48	0.9	25	<5
4	1	-	5	20	44	0.9	28	<5
5	1	-	5	22	48	0.8	27	8
6	1	DL	4	19	42	0.8	30	<5
7	1	-	4	24	53	0.8	29	<5
8	1	ADJ FRA	3	22	48	0.8	24	7
9	1	-	4	21	46	0.9	27	<5
10	1	-	4	18	40	0.8	25	<5
11	1	-	5	22	48	0.8	25	<5
12	1	-	3	25	55	0.8	24	10
13	1	DL	4	20	44	0.9	30	<5
14	1	-	6	25	55	0.8	22	8
15	1	CL	4	22	48	0.9	25	<5
16	1	-	3	20	44	0.9	24	<5
17	1	-	3	21	46	0.8	23	8
18	1	-	3	20	44	0.9	24	<5
19	1	DL	3	24	53	0.9	25	<5
20	1	-	5	25	55	0.8	20	10
21	1	-	3	21	46	0.8	25	<5
22	1	-	4	21	46	0.8	30	<5

23	1	-	4	18	40	0.8	25	<5
24	1	-	3	22	48	0.9	25	<5
25	1	-	5	24	53	0.8	22	8
26	1	-	3	19	42	0.7	26	<5
27	1	-	4	17	38	0.75	27	<5
28	1	CL	3	21	46	0.9	25	<5
29	1	-	3	21	46	0.8	25	<5
30	1	DL	3	17	38	0.9	22	8
31	1	-	4	19	42	0.8	24	<5
32	1	-	3	22	48	0.8	25	<5
33	2	-	3	26	57	0.9	22	10
34	1	-	4	22	48	0.8	25	<5
35	1	-	3	21	46	0.9	25	<5

S NO	VAS 1MON	ODS 1 MON	ODI 1 MON	VAS 2MON	ODS 2 MON	ODI 2MON	VAS 3 MON	ODS 3 MON
1	2	12	26	2	11	24	2	11
2	4	19	42	2	16	35	2	11
3	2	11	24	2	11	24	1	11
4	3	16	35	3	14	31	3	14
5	2	12	26	2	12	26	1	12

6	3	13	28	3	13	28	3	13
7	3	13	28	3	13	28	3	13
8	2	14	31	2	12	26	2	12
9	3	20	44	4	15	33	3	15
10	2	14	31	2	13	28	2	13
11	4	17	37	4	14	31	4	14
12	3	15	33	2	14	31	2	12
13	3	15	33	3	12	26	3	12
14	4	25	55	4	19	42	2	19
15	2	13	28	3	11	24	3	11
16	3	19	42	3	16	35	2	14
17	2	11	24	2	11	24	2	11
18	2	13	28	2	11	24	2	11
19	2	13	28	2	12	26	2	12
20	4	24	53	3	20	44	3	14
21	2	12	26	2	11	24	2	11
22	2	14	31	1	13	28	2	13
23	3	14	24	3	14	31	3	14
24	3	15	33	3	12	26	2	12
25	4	25	55	2	16	35	2	14
26	2	25	55	1	16	35	1	12
27	2	19	42	2	16	35	2	16
28	2	11	24	2	11	24	2	11

29	3	20	44	1	15	33	1	15
30	2	11	24	2	11	24	2	11
31	2	14	24	2	12	26	1	12
32	2	13	28	1	11	24	1	11
33	3	15	33	2	13	28	2	13
34	4	20	44	4	16	35	4	12
35	3	16	35	3	16	35	3	16

S NO	ODI 3 MON	VAS 6MON	ODS 6MON	ODI 6MON	VAS 12 MON	ODS 12 MON	ODI 12 MON
1	24	2	11	24	2	11	24
2	24	2	11	24	2	11	24
3	24	1	11	24	1	11	24
4	31	3	14	31	3	14	31
5	26	1	12	26	1	12	26
6	28	3	13	28	3	13	28
7	28	3	13	28	3	13	28
8	26	3	12	26	3	12	26
9	33	3	15	33	3	15	33
10	28	1	11	24	1	11	24

11	31	4	14	31	4	14	31
12	26	2	12	26			
13	26	3	12	26			
14	42	2	19	42			
15	24	3	11	24			
16	31	2	14	31			
17	24	2	11	24			
18	24	2	11	24			
19	26	2	12	26			
20	31	3	14	31			
21	24	2	11	24			
22	28	2	13	28			
23	31	3	14	31			
24	26	2	12	26			
25	31	2	14	31			
26	26	1	12	26			
27	35	2	16	35			
28	24						
29	33						
30	24						
31	26						
32	24						
33	28						

34	26						
35	35						

ABBREVATIONS

DOI	- DATE OF INJURY
DOA	- DATE OF ADMISSION
OCCU	- OCCUPATION (S –SEDENTRY,M- MANUAL WORKER)
AO	- AO CLASSIFICATION
DENIS	- DENIS CLASSIFICATION
GENANTS	-GENANTS CLASSIFICATION (WG- WEDGE, BI- BICONCAVE)
MOI	- MODE OF INJURY (SF-SELF FALL,RTA-ROAD TRAFFIC ACCIDENT ,FH – FALL FROM HEIGHT)
CO MORB	- CO MORBIDITIES (CAD- CORONARY ARTERY DISEASE, CLD – CHRONIC LIVER DISEASE , PARK – PARKINSONISM, DM – DIABETES MELLITUS
ST	- SPINAL TENDERNESS
NEU	- NEUROLOGICAL INVOLVEMENT
BLI/BOI	- BLADDER INVOLVEMENT /BOWEL INVOLVEMENT
FRANKEL	- FRANKEL GRADING
LEVEL	- VERTEBRAL LEVEL
AC	- ANTERIOR COMPRESSION
MC	- MIDDLE COMPRESSION
PC	- POSTERIOR COMPRESSION
CA	- COBBS ANGLE
AVH	- ANTERIOR VERTEBRAL HEIGHT

VAS	- VISUAL ANALOG SCORE
ODI	- OSWESTRY DISABILITY INDEX
ODS	- OSWESTRY DISABILITY SCORE
DOS	- DURATION OF SURGERY
ANAES	- ANAESTHESIA
NEEDLE	- VERTEBROPLASTY NEEDLE (G – GAUGE)
CEMENT	- VERTEBROPLASTY CEMENT
DYE	- UROGRAFFIN DYE
PEDICULAR	- UNI/BI PEDICULAR
NO. OF LEVELS	- NUMBER OF LEVELS
COMPLICATIONS	- DL (DYE LEAKAGE /CL CEMENT LEAKAGE /CE CEMENT EXTRAVASATION)
PRE OP	- PRE OPERATIVE
POST OP	- POST OPERATIVE
LP	- LOLLY POP